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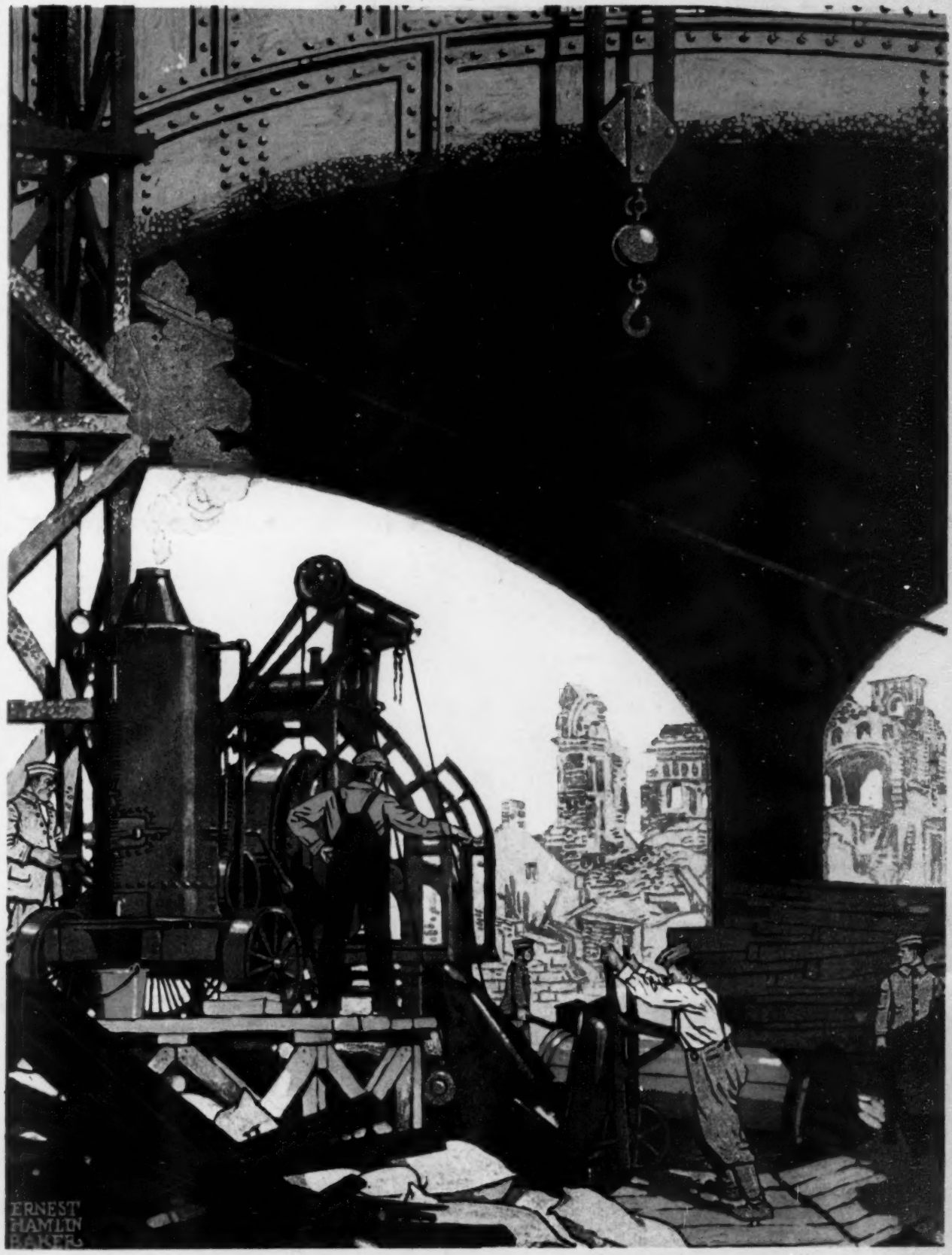

UNDOING THE HAVOC OF WAR IN THE COMING DAYS OF RECONSTRUCTION

Vol. CXIX. No. 25
December 21, 1918

Published Weekly by
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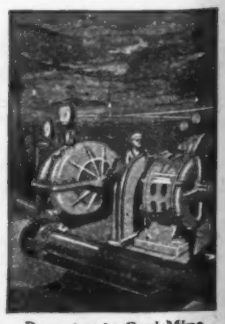

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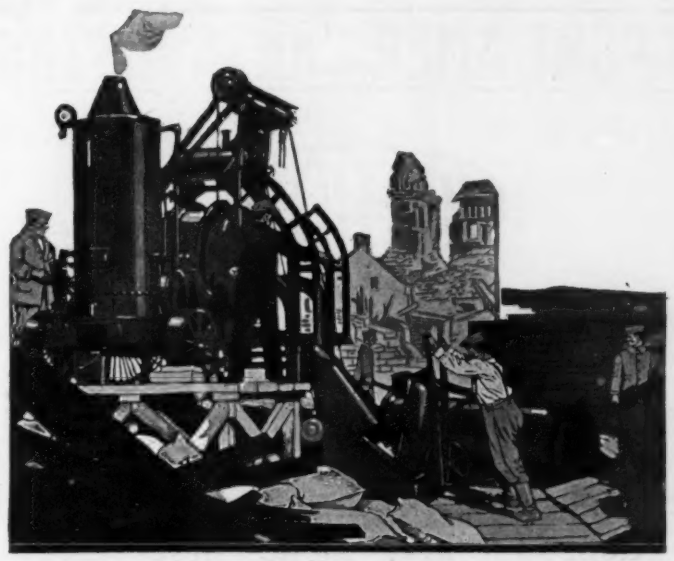

From the Cradle of Reconstruction

THE stupendous havoc of the great war is about to be undone. Armies are beginning to melt away under demobilization orders. The armed millions of the recent past are rapidly finding their way back into the industries. Homes must be provided for millions of homeless refugees, whose former abodes exist merely as the roofless, windowless and shapeless piles of stone, which dot those areas where armies have clinched in stubborn battle. Hundreds of miles of highway and railway must be built, to take the place of the shell-torn and bl sted and twisted lanes of travel in former theatres of war. For the thousands of factories, mills and shops in Belgium and France, whose looms and lathes, stocks of tools and materials have been carried away by the German invader, there must be pro vided new equipment and much raw material. This, and much more, comes under the simple head of Reconstruction. which is destined to be the title of the greatest story in the world's history.

Never before has there been such a wealth of material for the technical journalist. It is as though the erstwhile warring nations were being created for the first time; for, in truth, they are confronted with problems as numerous and as serious as those facing a new country.

And what may be said of the nations also applies to the individuals and organizations, who must readjust themselves to conditions which are not only peace conditions, but a *new variety* of peace conditions. Munition shops and war industries in general must turn their equipment over to products of commerce, and there is bound to be many a story of remarkable ingenuity in such industrial conversions.

The labor problems are among the most interesting of the many confronting the Allies, the Central Powers, and ourselves. In England and France, where the women have taken over 70 per cent of the work formerly done by the men, the problem of the women workers will call for no mean ingenuity and understanding. Likewise, the war's maimed will present an interesting problem; for the day of the soldier-beggar is a relic of the past in all leading countries. As a theme, the new order of labor will call for numerous stories.

There is a virgin field for the civil engineer in those parts of Europe where the flame of war has played. Confronted with the necessity of rebuilding entire towns and hamlets, the greatest engineers of the world are going to achieve marvels in the way of standardized construction. Already the French Government has laid plans for standardized dwellings, schools, public buildings, shops and other structures, so as to expedite the work and reduce costs. It seems fair to presume that the same procedure will be followed in the case of bridges, waterworks and other public enterprizes. There should be practically no end to the stories on great engineering feats achieved in setting Europe in order.

For the American business man, stories of the requirements of the new Europe will be of vital interest. Our soldiers, unconsciously perhaps, have effectively served as missionaries for our industries; for the European has come to understand us and is today ready and eager to enter into business relations with American firms, thus completing the new-found solidarity of the Old World and the New World.

The cradle of reconstruction is Europe. Belgium and France, and England to a lesser extent, will lead in reconstruction for the reason that those countries have been the greatest sufferers at the hands of Mars. In Belgium and France will be seen the great work of reconstruction at close range, while in England will be seen the reversing of Great Britain's giant war machine which brought millions of men and women into military service.

To the end of giving its readers the authentic history of the reconstruction period in Europe, the SCIENTIFIC AMERICAN has arranged to send a member of its staff overseas. Mr. C. H. Claudy, the Washington correspondent of this journal, has been chosen for this all-important mission. To the readers of these columns Mr. Claudy needs no further introduction; for his articles on numerous scientific and industrial subjects have been appearing in the SCIENTIFIC AMERICAN for the past fifteen years. With a vast experience in technical journalism, and provided with every reportorial facility, Mr. Claudy will have every opportunity of procuring many interesting themes for his versatile and prolific pen. His first reconstruction article will appear in an early issue.

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SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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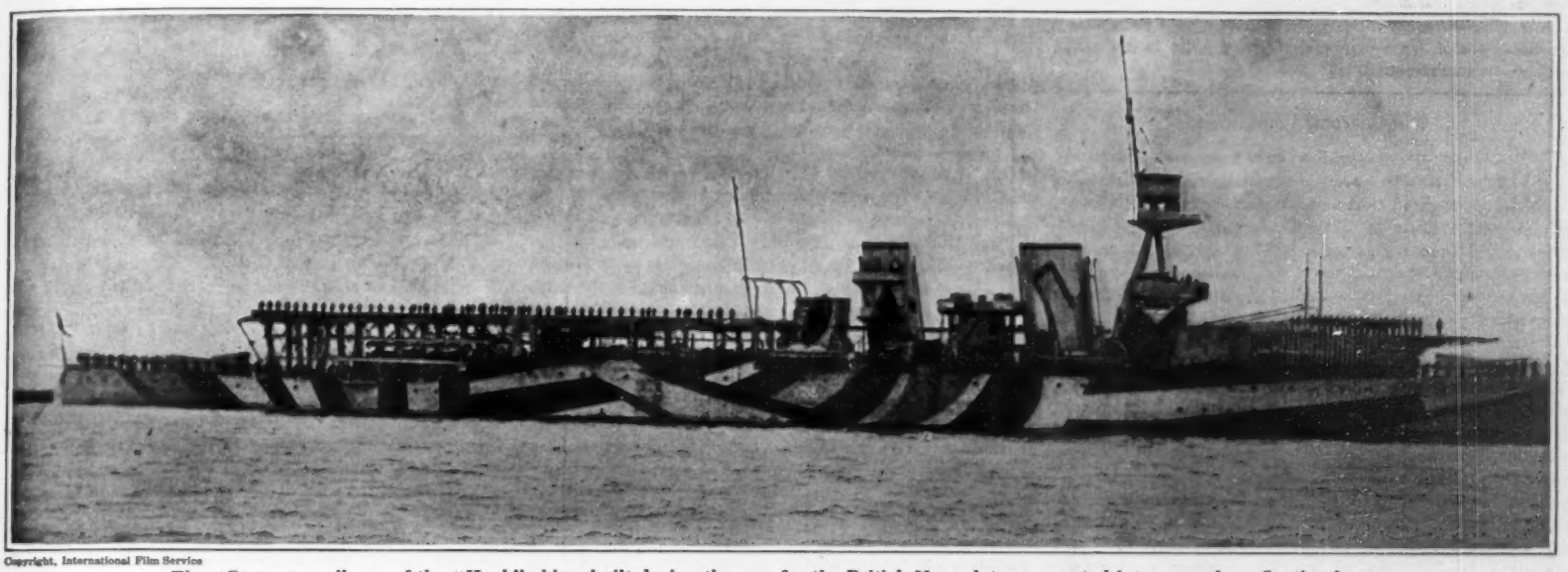

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The "Courageous," one of the "Hush" ships, built during the war for the British Navy, later converted into a seaplane floating base

The "Hush" Ships of the British Navy

IT has been generally understood that in order to meet the exigencies of the naval situation, Great Britain has built various novel types of war vessels, including gunboats for the River Euphrates, monitors armed with heavy long-range guns, which were used extensively against the German submarine bases on the Belgian coast, some battle-cruisers of great size and speed; and also some large and ex eptionally fast unarmored ships of a speed exceeding anything hitherto attempted in vessels of their displacement, either in the navy or the merchant marine.

The last named vessels have been popularly known as the "hush" ships. During the war no photographs nor any description was permitted to be made public. The SCIENTIFIC AMERICAN received confidential information that these ships were being built, but of course made no mention of them while the war was in progress.

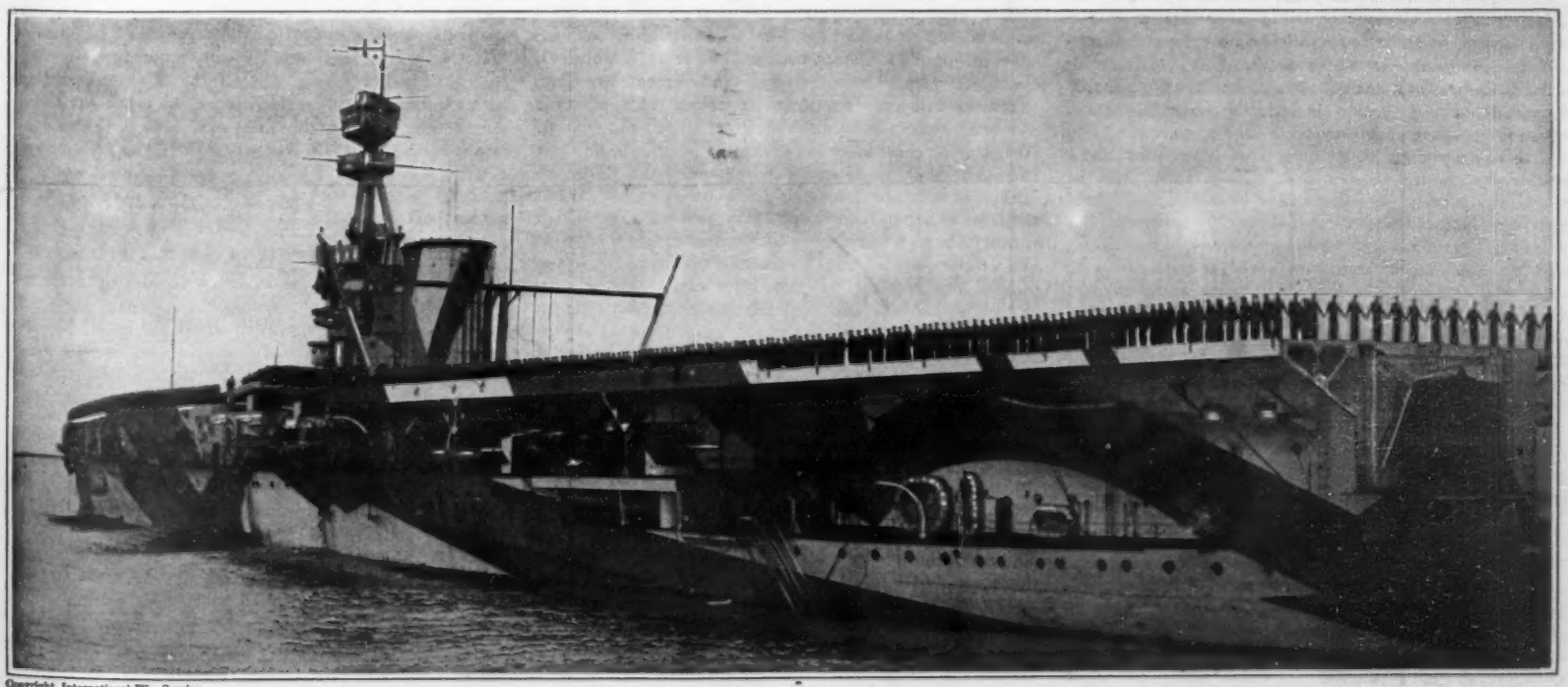
Now, however, the British Government has released pictures of these vessels, which presumably were among those taken of the British fleet during the German surrender. It is stated that five of these vessels have been completed, and one of them, the "Furious," is herewith illustrated. The idea underlying their design was to provide a vessel of such size and speed that it would be capable of overtaking any vessels of any kind whatsoever, even the fastest destroyers with speeds of 35 to 36 knots, and sinking them. In their proportions of length to beam and draft, they are practically vastly enlarged destroyers, the ratio of beam to length being about that of the destroyers, or, say, one to ten or one to eleven; also, their draft is very much less than that of a battle-cruiser or battleship. Moreover, like the destroyers, their entrance, run, and after body are exceedingly fine. They have the same characteristic lofty bow, with reduced freeboard throughout the after part of the ship. Like the destroyers, they are devoid of armor. They are driven by geared turbine engines, and although, for their length, the displacement is far less than that of a battle-cruiser, the horse-power must be approximately the same, if not greater, for we are reliably informed that they are capable of making and maintaining a sea speed of 40 knots. That they can make this speed and sustain it is suggested by the fact that when, following our entrance into the war, and French and British missions were immediately dispatched to the United States for consultation with our Government, one of these ships was selected to carry the British mission, including Sir Arthur Balfour, across the Atlantic, and made the trip, we learn from reliable authority, in three days' time.

Another remarkable feature is the main battery, which consists of only two 15-inch guns mounted in single turrets, one forward on the fo'c'sle deck, the other aft on the main deck.

There was always the possibility that one of the 28-knot German battle-cruisers or some of the fast German scouts might make a dash out of the North Sea, by night or in foggy weather, and prey upon Allied shipping. The cruise of the "Emden" and other German raiders proved that it was possible for a raiding ship to maintain itself on the high seas by supplying itself with coal and provisions from captured enemy vessels. It can readily be understood that, if the Germans had possessed the initiative and the courage to make such a break into the open (which we now know they did not possess), an armored cruiser or a group of 30-knot scouts could have created frightful havoc among Allied shipping, and it would have been very difficult to run down and capture them. These special ships, however, with their great size and sea-keeping qualities, and their high speed, would have been admirably qualified for meeting and defeating any such raiding enterprise on the part of the Germans before it had gone very far.

Subsequently, two of these ships were converted into mother ships for seaplanes, of which they were capable of carrying a large number. The changes involved the

(Continued on page 504)



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The "Hush" ship "Furious." Length 840 ft. It is stated speed is 40 knots, and that this ship crossed the Atlantic in three days on a special mission

SCIENTIFIC AMERICAN

Founded 1845

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Aircraft Situation

THE alacrity with which Great Britain and Canada have already planned a seven-year aircraft building program that contemplates the expenditure of $100,000,000 and $50,000,000, respectively, per year, offers good food for thought. That simple statement reveals plainly the necessity of our keeping alive an industry that has grown out of all proportion to ordinary peace-time demands, if we are to be a factor in making the commercial airplane a success.

The signing of the armistice finds us with a wealth of airplanes and engines, and a stupendous personnel for immediate military needs. Such a state would ordinarily beguile us into that sense of security born of an embarrassment of riches in flying craft, were it not for the disquieting thought that only through constant and consistent development can we hope to maintain ourselves militarily and commercially. For it is a fact that our air equipment of today may be obsolete tomorrow. The situation parallels that of the Navy, where a constant building program is in operation year after year, new design upon new design.

So it seems that in the readjustment of our National industry provision should be made by the Government for those private enterprises that have played so great a part in the realiation of our air program. Not only have these enterprises established a vast aeronautical industry, but they have partially financed it. It seems that a constructive program, based upon a minimum schedule of our needs, should be provided for in our 1919 appropriations; for until the aeronautical industry can find itself and stand on its own bottom commercially, it needs and should have the paternal guidance and financial support of the Government.

We cannot expect to turn the industry loose and tell it to make its own way commercially, until, at least, general flying is possible in this country. And it is quite evident that we are very far from that possibility at this time, and will continue to be until much legislation has been passed regulating and controlling the air as the highways and waterways are controlled.

Meanwhile, we face the possibility of the industry going out of business; or, at least, of committing itself to the manufacture or fabrication of widely different products far removed from the flying art, in order to maintain its existence and justify the investment. All this results in enormous cost and some loss of time if the industry must be re-established on a basis comparable to the recent war requirements. But it is unavoidable, unless we, as a nation, satisfy our already apparent requirements and carry this industry over the hiatus between war-time and peace-time conditions.

Our requirements are many. Our Army and Navy necessarily should receive first consideration; but in excess of military needs we have those of the Postal Service, Coast Guard Patrol, Forestry Service, Geographical Survey, Life Saving Stations, exploration, and the like. Even these are schools for the embryonic military flier, or offer a career for our returning airmen. With only ordinary vision one sees the necessity for the development of the flying art and the further evolution of its devices, if we are to keep pace with our sister nations. The very character of aviation makes it of nation-wide interest and use, and compels consideration of the establishment of flying fields and schools in every State in the Union for military as well as commercial uses, where there could be maintained at least 200 air squadrons to form the nucleus of our air force.

Why not consider at least $100,000,000 for our next year's air program? Whether this development shall be assigned to purely military uses or for the equipment of the other great departments of the Government, is something for the Government to decide. The outstanding fact remains that we do need the development, and any doubts on this point or on our ability to stand at the forefront of aviation, are quickly dispelled when we remember that the last six months of our concentrated work produced men, machines and motors equal to the best of any the world over. And now, with peace once more, are we to maintain our aeronautical position or are we to fall behind the other great nations?

Reconstruction

MODERN war is essentially a manufacturing and industrial problem. Four-fifths of the men engaged are required to manufacture the supplies and equipment of the soldiers in the trenches.

When this country became involved in the European struggle, our manufacturers and business men, volunteered their services without compensation in order to help the Government in its hour of need. The successful outcome of the war is due in large measure to their patriotic self-sacrifice.

Now we are confronted with another problem, equally grave, if not much more so, than that of adjusting our peace time industries to a war basis. Again, this is a manufacturer's problem, and we must look to the American manufacturer and business man for its solution. Of course, it is impossible for him to deal with the endless complexities of reconstruction without governmental aid, but his advice in the present crises merits the highest consideration.

In the first week of December, there was convened at Atlantic City a vast assemblage of manufacturers and business men from all parts of this country to deal with the question of reconstruction. The importance of this convention may be gaged by the numbers of delegates who attended. They came in thousands and the vast auditorium in which the meetings were held was taxed to its utmost capacity. Out of the hundreds of resolutions offered a clearance committee selected and formulated some thirty resolutions which, with the exception of a few dissenting votes in the case of one resolution, were passed unanimously. As they voiced the opinions of the leaders of practically all industries in this country it is of the utmost importance that Congress should give them careful heed.

The Convention declared itself in favor of cancellation of war contracts as soon as possible, with equitable compensation for the contractor and prompt payment by the Government so that the funds might be used in peace industries. It was realized that labor is part of the wealth of the country and it is economically unsound to continue the manufacture of war materials for the mere purpose of keeping men employed. The Secretary of War has stated that the raw materials and finished products accumulated by the War Department will be distributed when and where they will least interfere with the return of industry to a normal condition, and the War Service Committee of American Industries offered its services in advising the War Department in the disposition of such materials. It was resolved that all war regulations of industry should be revoked just as soon as practicable.

The Government was urged to investigate the so-called "pivotal" industries which have been developed as a result of the war. Upon many of these, although relatively small themselves, the continuation of some of our largest industries has depended, and some of them are indispensable for the safety of our military establishment as well as our industrial structure. The war has taught us the advantages of industrial coöperation. And it is urged that now, in time of peace, these same advantages may be attained by coöperation of various units of industry, provided they are pursued under proper Federal control.

Not only is coöperation between industrial units essential to the highest progress of the nation, but also coöperation between capital and labor. Mr. John D. Rockefeller, Jr., promulgated a labor creed, to which the convention gave unanimous approval. This called for a much closer community between labor and capital. It declared that labor and capital are partners, not enemies; that community is an essential party to industry and it should have adequate representation with the other parties; that every man is entitled "to earn a living, to fair wages, to reasonable hours of work and proper working conditions, to a decent home, to the opportunity to play, to learn, to worship, and to love, as well as to toil, and that the responsibility rests as heavily upon industry as upon government or society to see that these conditions and opportunities prevail."

In order to provide employment for the men who are now engaged in the war industries, and also for the millions returning from military service, it was urged that the Government undertake public works of every sort which would employ unskilled labor. We have launched a vast merchant marine program and this should be continued in order that American goods may be carried in American bottoms to foreign markets. But this work was undertaken as a war emergency measure and we have not at the same time developed our port facilities, dry docks, etc., to a degree commensurate with the growth of our merchant marine. Here there is an opportunity for the Government to provide occupation for labor.

The Convention drew attention to the waste of water power in this country and urged that Congress take immediate action on this subject in the public interest.

As an outlet to the vast increase in manufacturing which this country is soon to see, it was urged that measures be taken to develop foreign trade, and attention was particularly called to the necessity of training young men in the practises of overseas commerce and finance and in the practical use of foreign languages. The value of research work has never before been appreciated by the business man to the extent that it has during the emergency of this war. The beneficial work of the Forest Products Laboratories was recognized by a special resolution and the Government was urged to extend and adequately maintain this excellent work.

Such, in brief, is the gist of the opinions and suggestions expressed at the greatest convention of business men ever held. There was no feeling of apprehension. There was work in sight for all. An air of confidence pervaded the Convention in the ability of the American manufacturer and man of business to handle the difficult problems of reconstruction in a way which holds bright prospects for the future prosperity of this country.

A Department of Inventions and Discovery

AT one time or another, here and in other places, the weak points of our present patent system have been more or less fully brought forward.

Various remedies have been suggested for some or all of these abuses; but none has gone to the root of the trouble. This is, briefly, that the Patent Office is tied up with things that do not concern it. It is a Bureau of the Interior Department. So are the Pensions Bureau, the General Land Office, the Bureau of Mines, the Geological Survey, *et al.* If one of these bodies gets an increase in staff or in salaries, an enlarged research library, an additional subdivision, or new electric lights, it is human nature that each of the others, officially on an equal footing with the favored one, will come forward with a need which, to it, is just as pressing and which, to it, corresponds exactly with the one that has been met.

On another page of this issue, Mr. Ewing, ex-Commissioner of Patents, makes it plain that the source of the trouble lies right here, in the impossibility of getting Congressional action for the Patent Office commensurate with its needs. He makes it plain that this is because of the way in which Patent Office appropriations are bound up with those for other Bureaus that have nothing to do with the Patent Office. This would no longer be the case if these needs were presented by a Secretary of Inventions and Discovery, who could go before Congress, not on a footing of equality with the Alaskan Engineering Commission and the National Park Service, but rather on a level with the Secretaries of War and State and the Postmaster General.

The Department of Agriculture was originally a minor section of the Patent Office, whose principal function was to issue seed to farmers. It never amounted to much more than this until it was made a full executive Department, with a Secretary of Cabinet rank; but since it went on that footing, it has expanded to a point where it has normally some 15,000 employees engaged in promoting one general line of industry.

Mr. Ewing tells us that there is granted, annually, one patent for each 500 families. It is clear that, on this very account, the business of invention and discovery can never hope to get behind it the same political impulse as the business of farming, in which are engaged an actual majority of the constituents of many Congressmen. But in spite of the fact that patents seem in this way to touch directly but a small proportion of us, they are really of vital importance to the entire business and manufacturing community. In importance and in complexity the business of inventing is quite on a par with the business of agriculture or the business of communication; it is therefore just as worthy of the recognition involved in having a separate executive Department devoted to it; and if it got this recognition, it would be possible to eliminate the notorious weaknesses of the present patent system in short order.

Oil from Beechnuts in the Netherlands

MEASURES are being taken by the newly appointed Dutch Minister of Agriculture, Industry, and Commerce to increase the supply of edible oils in the Netherlands by making full use of the domestic beechnut crop. He estimates that between 2,000 and 2,500 metric tons of these nuts may be collected if every effort is made, and that from this amount of raw nuts 300,000 to 400,000 kilos of oil may be obtained. This would afford a valuable addition to the dwindling stocks of edible oils in the Netherlands. The *Zutphen Gazette* reports that school children are to be employed to gather the nuts. A price of 25 florins per 100 kilos (about 5½ cents per pound at the present rate of exchange) will be paid to the gatherers. Owners of private lands from which beechnuts are gathered will receive compensation at the rate of five per cent of the sums paid to the gatherers, and they will also have the right to purchase cattle cake, prepared from the pulp of the nuts from their property, at 50 florins per 100 kilos.

Naval and Military

British Ships Sunk During the War.—Sir Eric Geddes states that during the war 2,475 British ships were sunk with their crews beneath them, and 3,147 vessels were sunk and their crews left adrift. The personnel of the merchant marine service was heavily hit, the total number of casualties exceeding 15,000 men. The U-boats carried on continuous warfare against the fishing fleets; the total number of fishing vessels sunk being 670.

Our Losses in Merchant Ships.—The Bureau of Navigation of the Department of Commerce has made public a report, which shows that the United States lost 145 American passenger and merchant vessels of 354,449 tons, and also 775 lives, through acts of the enemy in the period from the beginning of the world war to the cessation of hostilities on November 11th. The report does not include several vessels, the loss of which has not been established as due to acts of the enemy. Nineteen vessels and sixty seven lives were lost through torpedoes, mines, and gun fire, prior to the entrance of the United States into the war.

Naval Strength in 1920.—Rear Admiral Taylor, Chief of Naval Construction, told the House Naval Affairs Committee that when the 1916 program of construction and the program laid down during the war have been completed, the navy will have over twice the number of ships it had before the outbreak of the war, this being exclusive of 350 wooden submarine chasers, which the navy expects to sell or put out of commission. Destroyers represent the backbone of the increase. Of these we have 100 in commission, and 240 more will be added in the next 18 months. By July, 1920, the total number of vessels will be over seven hundred.

Wooden Ships a War Emergency Measure.—SCIENTIFIC AMERICAN was one of the first journals to advocate the building of wooden ships. We did this in the height of the submarine crisis, when the cry for ships was urgent. Wooden ships required an inexpensive plant for their construction, they could be built rapidly, and the material for construction was abundant and ready to hand. Henceforth we should concentrate on steel ships and ships of a larger individual tonnage than the wooden ships, which run from 3,000 to 3,500 tons. Mr. Piez of the Emergency Fleet Corporation states that the Shipping Board wishes to cancel the contracts for 150 wooden ships. There can be no question of the wisdom of this policy.

Captain Persius on German Submarines.—The naval critic, Captain Persius, recently stated in the Berlin press that in 1917 only 83 submarines were constructed, while 66 were destroyed. He tells us that in April 1917, Germany had 126 submarines and in October, 146. In February, 1918, she had 136 and in June of this year, 113. He verifies the statement of Admiral Sims that very few submarines operated at one time. In January, 1917, only 12 per cent were active, while 30 per cent were in harbor, 38 per cent under repairs and 20 per cent incapacitated. Submarine crews were insufficiently trained and distrusted the submarine, while experienced seamen looked upon the submarine warfare as a "political stupidity."

Casualties in the War.—An exchange telegraph dispatch from Copenhagen states that Austria-Hungary suffered a total of over 4,000,000 casualties in killed and wounded, the total number killed being 800,000 men and 17,000 officers. The Socialist *Vorwarts* of Berlin places the total German losses at 6,330,000, of which about 1,600,000 were killed and the fate of 260,000 is unknown. The total number of prisoners is put down as 490,000. An official announcement from London states that the first official figures of 658,665 British killed did not include men reported missing, or who died through accident or sickness, and it gives the total from all causes as a little over 1,000,000 dead. The American casualties to date total 250,000, of which 36,154 were killed and 17,000 died through disease or causes not classified.

The Proposed North River Bridge.—Major S. Wood McClave, representing the Jersey Association and the Hudson River Bridge Committee, urges the construction of a Hudson River bridge at 57th Street, in accordance with the plans of Gustav Lindenthal. The design calls for a two-deck bridge, with tracks for freight, passenger and trolley cars, and roadways for trucks, automobiles, and foot passengers. The bridge is to be associated with a marginal elevated street and railway system along the Manhattan water front, with tracks entering each pier and the warehouses on the opposite side of the street. This structure, with its clear span of over three thousand feet and its four steel piers, each as lofty as the Singer Building tower, would be the most monumental work of its kind in the world. As compared with tunnels, the bridge would be infinitely superior, providing, if we include the steel railway and trolley track, the automobile driveways, and the foot passenger promenades, ten times the capacity of a two-track tunnel. In proportion to its traffic capacity it would cost far less.

Science

A Hospital for Birds is described in *Bird Lore*, Dr. W. W. Arnold, of Colorado Springs, is the proprietor of this unique institution, which consists of a commodious aviary, in which he has constantly from twenty-five to thirty feathered patients, including birds disabled by contact with wires and by various other accidents incident to their migrations across the country. The doctor is gaining a fund of knowledge concerning avian traits and habits in the course of his ministrations.

Minerals Useful in War.—A timely exhibit recently installed at the American Museum of Natural History, in New York City, illustrates the uses of minerals in warfare. Here are shown the successive steps in the production of war munitions, from the raw material to the finished product. The exhibit includes, for example, a sectional barrel of the three-inch naval gun, with its lining of molybdenum steel, the metal that best resists the erosion caused by the gases developed by smokeless powder. One feature of the exhibit is a comparison of modern munitions with those used during the Civil War.

The Flint Ridge District, between Columbus and Zanesville, Ohio, is an outcrop of flint-bearing limestone, extending for ten or more miles, the entire surface of which is covered with pits dug by prehistoric miners while searching for flint suitable for making implements. Adjacent deposits of flint chips or fragments, struck off from larger pieces in the making of arrowheads and other objects, reach in some cases a depth of 15 feet and the material is now used in the vicinity for road-building. An archæological survey of this remarkable region is being carried out under the direction of Dr. W. T. Mills, state archæologist of Ohio.

Ground Connections for Electrical Systems.—Technical Paper No. 108, recently issued by the Bureau of Standards, contains the results of an investigation of methods of grounding electrical systems for protective purposes. A section of special interest to practicing engineers contains results of resistance measurements on types of ground connection now in use in 37 cities in the United States. In few places is it found practicable to obtain adequate protection from electrical dangers by means of grounds made with electrodes of small extent, such as driven pipes, plates, etc. For continuous and reliable protection it is necessary to utilize water pipes or common ground wires which connect plate grounds in parallel.

The War Emergency Entomological Service organized in the Department of Agriculture, at Washington, has enabled that department to keep informed, almost from day to day, of the extent to which the principal crops of the country are attacked by injurious insects. Reports are sent in by a large corps of collaborators, including the entomologists of the agricultural colleges and experiment stations, teachers of entomology at other institutions, Forest Service field workers, county agents, and many others, whenever an undue increase is noted in the prevalence of any injurious insect in any locality. The information thus centralized is distributed promptly, in order to head off prospective outbreaks as far as possible.

The Manufacture of Surgical Instruments in the United States has made rapid progress since the war began, though it still has many serious difficulties to contend with, the greatest of which is a scarcity of skilled labor. This industry is dealt with in detail in a recent report of the U. S. Tariff Commission. Few people realize the immense number of types of surgical instruments used not only by specialists but also in general operations. One of the largest importing houses claims to be able to supply any one of 10,000 items in the surgical instrument line, while representative retail dealers carry in stock from 6,000 to 7,500 different types. The processes of manufacturing these instruments involve an astonishing variety of expert hand labor. For example, in making the hæmostatic or artery forceps, an instrument of comparatively simple appearance, no less than 72 separate processes are employed, some of them consuming only a few seconds and others an hour or more. Formerly the handles of most instruments were made of wood, ivory, rubber, etc., but nowadays metal alone is used, because it is found that only such handles will admit of continued and perfect sterilization. The value of all the surgical instruments produced in the United States in 1914 was $1,400,000, while the importations, mainly confined to steel instruments, were valued at about $1,600,000. Of the foreign-made instruments 95% came from Germany. The result of the war has been standardization of types of instruments produced in this country and the introduction of labor-saving machinery in place of hand work. Many complicated and delicate instruments are now made in the United States by machinery, and quantity production has resulted in striking reductions in prices. For instance, ophthalmoscopes at the beginning of the war were imported at a cost of $25 each; now, by the use of quantity methods, they are being turned out in this country at $5 each.

Engineering

Wave Pressure on Ships.—The Concrete Ships Division of the Emergency Fleet Corporation has been undertaking some experiments to determine the pressure of waves on the hull of a ship, particularly with the view of discovering the stresses to which concrete freighters will be subjected. A special testing station has been established at Atlantic City under the direction of Professor F. R. McMillan. He has determined that pressure does not follow the hydrostatic laws, as the dragging effect of the water reduces the pressure at the crest of the wave and increases it at the trough. This discovery should have a material bearing upon the study of hull stresses.

Reconstruction of China's Grand Canal.—The oldest canal in the world, dating back nearly 2,500 years, and also the longest canal, measuring in the main section nearly one thousand miles, is that extending from Hanchow, south of Shanghai, China, to Peking. Most of this canal has been filled with mud by overflows of the Yellow River, but the southern portion of it still constitutes a very busy waterway. The canal is now to be rebuilt and improved. The project is too vast to be done at a single operation and the funds are not at hand. At present, about $6,000,000 are available and this sum will be used for the improvement of a section about a hundred miles in length, leaving to a later date, when funds can be accumulated, the reconstruction of other sections. The work is to be undertaken by American engineers.

Strength of Brick Piers.—The Bureau of Standards has just published its final report on an investigation of the strength of large brick piers, which was conducted in the Pittsburgh Laboratory of the Bureau of Standards in coöperation with the National Brick Manufacturers' Association. Tests were made on 46 piers 30 inches by 30 inches by 10 feet high, and four supplementary piers of the same cross sectional dimensions by 5 feet high. Transverse, compression, and absorption tests were made on each lot of bricks used. The bricks used were representative of four districts east of Mississippi River, two or more grades of brick being obtained from each district. Three kinds of mortar were used in the beginning and three grades of bond and workmanship employed throughout the investigation. This report, under title, "The Strength of Brick Piers," is now ready for distribution and those interested may obtain a copy by addressing a request to the Bureau.

Compressed Concrete.—In a recent issue of the *Engineering News Record*, Mr. Frank McKibben, Professor of Civil Engineering, Lehigh University, gives some interesting data on the increase of strength in concrete columns, produced by compressing the concrete. The columns were approximately 5 feet long and 14 inches in diameter, composed of 1:2:4 concrete. Some of them were molded without pressure while others were compressed during the molding. They were subjected to compressive loads varying from 160 to 260 pounds per square inch. Each of these columns was molded in five layers of 12-inch depth and each layer was compressed by means of a plunger. The ordinary concrete columns weighed 147 pounds per cubic foot, as against an average of 153 pounds per cubic foot for the compressed concrete columns. While the ordinary columns failed by crushing, the compressed columns failed more suddenly, splitting longitudinally for a considerable portion of their length. The compressed concrete showed a much higher ultimate strength. Those tested at the age of 28 days gave an average compressive strength of 1,774 pounds for the uncompressed concrete as against 2,680 pounds per square inch for the compressed concrete.

Concrete Floors for Foundries.—The superiority of concrete floors for all kinds of foundries is claimed by an authority before a recent convention of American foundrymen. From an experience of 10 years with concrete foundry floors, he claims advantages for the concrete floors because they can easily be kept clean with very little expense of labor and time, the molds stand level and straight and thus avoid the not inconsiderable loss of castings resulting if the molds are not level, the molder cannot dig holes in the floor with his shovel, which is frequently the case on other floors; the straight and smooth surface gives the men carrying iron a safe path and prevents them from stumbling into the holes of an ordinary clay or gravel floor. Additional advantages are had where electric truck distribution is used, as the cores can be transported without breaking them, and in case a sand-cutting machine is used to cut the sand the strain on the machine is less on a level, solid foundation and it can cut the sand to the ground without any chance of damaging the machine. The argument that concrete is hard on molders' feet does not hold good, the author explains, as the molders are always standing on sand just as they do on gravel or clay floors. He also states that if given their choice after experience on various kinds of floors, the molders would prefer concrete.

A Place for Every Man

Getting the Jobless Man and the Manless Job Together

By C. H. Claudy, Our Washington Correspondent

THE United States took four million men from industry and put them into khaki. Two millions of them are coming slowly back from foreign soil, to be reabsorbed into the body politic. The other two million are to be demobilized as rapidly as possible.

If it were practical to throw two million men upon the country at once, each one with only $30 in pay and a ticket to his home in his hand, chaos would result. There wouldn't be trains enough to carry them, there might not be roofs enough available to cover them, and there might not even be food enough to give them meals. Certainly, while there are two million manless jobs waiting for two million jobless men, the two could not connect overnight.

It was the sad experience of many a lad who volunteered in the Spanish war to get demobilized, enjoy a hectic week of entertainment and lionizing, and then be forgotten, to walk the street, looking for work, for food, for shelter.

In 1898 we had a few hundred thousand men to demobilize and absorb into industry. Now we count in millions.

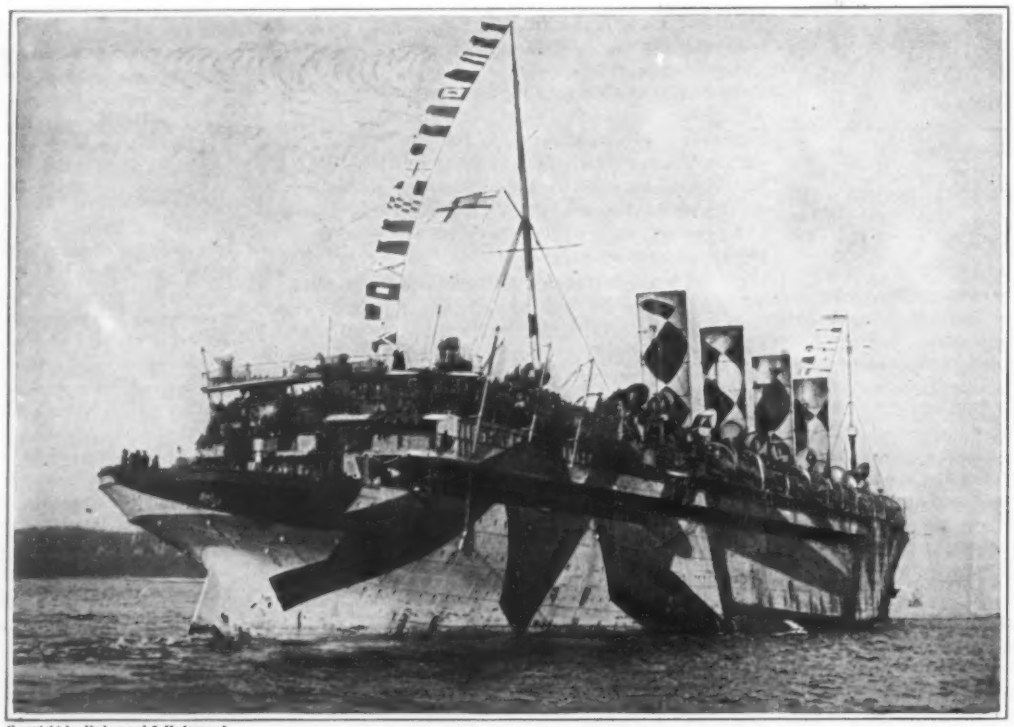
Moreover, we begin demobilization at the very worst time of the year, as far as reabsorption is concerned. December, January and February are no months to begin road work, building construction, public enterprises. The very time when a man needs a job, money, warm clothing, shelter, the most, is the time when he has least opportunity to get it—if left to shift for himself.

The kindly paternalism of a really interested government provides that every demobilized and discharged soldier or sailor have transportation to his home. But no paternalism can put old heads on young shoulders, or make them *use* that transportation. The result is, if left to themselves, many lads will spend all their money "making up for lost time" and then dispose of their transportation for more money to have more good time, only suddenly to find themselves penniless, far from home, workless, and hungry.

There is another side to this demobilization and redistribution of labor problem, which has far less a humanitarian appeal than that just outlined, but which is equally important to the country as a whole—the side of the employer of labor who wants help. Certain sections of the country have beeen stripped of labor, and need it badly. Other sections have been able to make up the labor shortage to some extent with older men, mere lads, or women. But these will probably be glad to get hold of their own people again. Yet, if they get hold of enough of them, and fast enough, they will merely shift the problem from the jobless man who is given a job, to the shoulders of the man or woman with a job who is suddenly let out of a job . . . and shifting the question from one pair of shoulders to another will not solve it.

However, the question is being answered, and the problem is being solved, and by the government. This is a new day and age. It is no longer 1898. In the Spanish war if an enlisted man got drunk he was punished—and could get drunk again. In this war we solved that problem by making it impossible for the uniformed man to get anything to drink. In 1898 we cast out hundreds of thousands of patriots who had volunteered and told them to get jobs If they did, it was fine. If they didn't, it was hard luck. The government attitude was that of "we should worry!"

Today we look at things differently—perhaps because we feel that our lads didn't volunteer—they were taken. They were taken from farm and field and factory and business office, and the country wants to see that they are put back from where they came, with every man an equal opportunity, and no man or no business damaged, more than is necessary, by the temporary hiatus in work caused by war and service.



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The "Mauretania" steaming into New York with 4,000 American troops aboard

The agency for this is the United States Employment Service which, with the active coöperation of the Council of National Defense and its 184,000 units throughout the nation, proposes to see that every man with a job gets carried to that job, and that no man is mustered out of any service unless a job is waiting for him—the job he wants to do, can do, in the place (or as near it as possible) in which he wants to do it. Moreover, the Service feels that this attitude must apply not only to soldiers and sailors, but to war workers generally—the stenographer who came from Michigan to Washington because the Government needed her, the painter who came from Galveston to Hog Island because the Government needed him, the munitions worker who left a loom or a bench or a farm or a store because Bridgeport called with Uncle Sam's voice, loud enough to be heard in Oklahoma—or to be heard in Oregon, for that matter!

Just now this apparent impossibility is being accomplished is interesting, and unique. It is unique because it finds the United States Government perfectly willing to ask aid of, and coöperate with, those extra-governmental agencies which, prior to this war (the Red Cross excepted) had never before any official standing with the Government.

There is first, a central committee, which is formed of representatives from five divisions of the Army—the General Staff, the Adjutant General's office, the Morale Division, the Personal Classification Branch and the Division of Education and Special Training; with which representatives work those from the United States Navy, the Department of Agriculture, the Council of National Defense, the War Labor Policies Board, the War Industries Board, the Federal Board of Vocational Education, the American Council of Education, the American Federation of Labor, the American Red Cross, the Young Men's Christian Association, the National Catholic War Council, the Knights of Columbus, the Jewish Welfare Board, the Young Women's Christian Association, the General War Time Commission of Churches, the War Camp Community Service and the Salvation Army.

The purpose of the Service, working through its central committee, is to establish in every community, from the small town to the largest city, a bureau where the returning soldier or sailor may ascertain what employment is open to him. While most soldiers will return home many are going to cities where they are relatively unknown. Wherever they go, it is the duty of the community to see that every possible opportunity is given to them to get the best jobs for which they are qualified. To some of these men their old positions remain open; with others, such is not the case. Some have acquired new purpose and strength and in many cases new skill, which fits them for better work than they had formerly.

To fit the right man to the right job needs local care as well as national. Hence the Community Labor Board must come into being and function. These local boards are composed of one representative of employers, one representative of labor, and one representative of the Service, throughout the country, over 1,580 in number. The Service has in addition some 850 offices scattered throughout the country and has volunteer agents in other places.

With the approval of the Secretaries of War, Navy, Agriculture, Interior, Commerce and Labor, sitting together as a Council of National Defense, the Employment Service, with the assistance of the State Councils of Defense and their Community Councils, has undertaken to organize in every city and town throughout the country a Bureau for Returning Soldiers and Sailors,

Vanguard of Pershing's Army disembarking from a Lackawanna ferryboat

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Troops on the way to Camp Mills where they will be detained before being mustered out

and, speaking broadly and within the limits of possibility is prepared to see that every man and woman demobilized from war work shall have a chance at the work that he or she can do best in or near his or her own home.

To this end the coöperation of manufacturers, farmers, business men, builders, heads of commercial activities of all kinds is being sought and obtained—must be obtained in complete and enthusiastic response if the whole system is not to break down.

That this may be seen at a glance, the typical case of one demobilized soldier may be considered.

John Smith is about to be given his discharge, his month's pay, his ticket home. Before he gets them, the single employment representative permitted in his camp sees him, finds out his name, address and business. John Smith is a pipe-fitter, his home is in Toledo, Ohio, and he wants to get back to work.

The Washington (home) office of the Service is notified. It is also notified from every other camp and demobilization point, all over the country, of all the men who want jobs, and here the clearing is done, so that when a wire goes to Toledo, it may ask for jobs for 5 steam fitters, 14 carpenters, 10 paper hangers, 47 day laborers, 2 bookkeepers, 1 stenographer and 16 street railway men, to arrive on or about January 1st.

It is then the business of the local unit in Toledo to go out and find these places. Obviously, if the Toledo business man has been on his job, he has long ago notified the local unit of just what he can do in the way of providing jobs. If he hasn't, the local unit proceeds to find out. And long before John Smith starts from Devens or Meade or wherever he may be, for Toledo, he knows there is a job waiting for him, fitting pipe, at Brown, Robinson and Jones, and that all he has to do is go and get it.

Not only is the Service enlisting the aid of existing businesses, but it is stimulating the revival of building, municipal, township, county and state construction. We have four years' building to do, right now, but the general tendency is to wait for lower wages. This is wrong, because the emergency is of the present, not the future. The service is attempting to bridge the gap between getting out of the government service and into a good job. It will not help if every one sits back and waits until these men flood the streets with jobless men, to force down wages. That way lies Bolshevism. What is needed here, now, is a job, for a man who has served his country and who wants to work.

Road work, municipal buildings, construction schemes of all kinds, will help mightily to absorb both the released skilled and unskilled labor, and, by so doing, help as patriotically to solve a big national problem as did the buying of bonds or the subscription to war activities.

(Continued on page 504)

Our Fastest Aircraft—The Loening Monoplane

THE new airplane records established at Dayton, Ohio, a few days ago for both speed and altitude with the Loening monoplane, marked the latest achievement in America's preparations for the great war, now happily ended. The world doubted that we could construct serviceable aircraft for our military forces. Yet we succeeded in turning out large numbers of training planes, followed by general utility planes of the DeHaviland Four type, and the huge Handley-Page and Caproni bombers. But could we construct speedy planes suitable for aerial combat? That was the universal question; and we answered it with the Loening monoplane.

Speed is one of the great factors in combat plane design, and our new record of over 145 miles an hour makes us supreme in this particular over every other nation in the world. Doubtless further development within the next year will meet and probably surpass this record, and this again points to the necessity of our maintaining our present aeronautical impetus. But for the time being, we lead in the matter of combat planes. The altitude record made by the Loening machine is equally important. Twenty-five thousand feet in 43 minutes is nearly twice as fast as the former record for a two-man machine with full military equipment. Thus we have succeeded in producing a two-seater which possesses the speed and climbing ability heretofore associated only with the single-seater scouts.

The Loening machine, which is illustrated in the accompanying view, is a monoplane of entirely new design in so far as the wing support is concerned, requiring but one-tenth the number of parts of the ordinary European design. Wire stays are eliminated in spite of the fact that the monoplane construction is for the first time made as strong and rigid as any biplane without losing any of the well-known speed advantages of the monoplane type.

The Loening monoplane—the world's fastest two-seater fighting machine, which carries its own weight in useful load

The wings of the new machine are mounted on a level with the pilot's eyes and the visibility is therefore perfect. When carrying full military equipment, *i. e.*, two men, four machine guns, 2,000 rounds of ammunition, and so on, both pilot and gunner have practically no "blind spots." The machine carries a heavier load per square foot of wing surface than has ever been carried before. The landing speed, in spite of the monoplane feature, is comparatively low—a great step in advance in fast airplane construction and design. Most of the fatalities that have occurred in aeronautic work abroad in fast combat type of planes have been in landing.

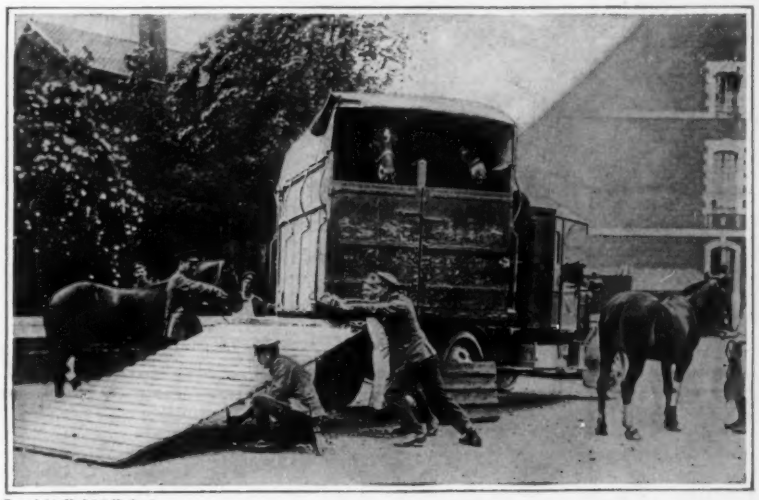
Perhaps the most startling features of the new plane are its stability and control in all sorts of maneuvers; it it is probably the first load-carrying machine that can be maneuvered equally with the smallest single-seater combat and pursuit machines. It can practically carry the equivalent of its entire weight in a live load. This is interesting because previous machines have been able to do little better than carrying 50 per cent of their own weight.

One of the principal reasons for the success of the Loening plane is its extremely low weight in proportion to its power. Each horse-power developed by the engine has only to lift eight pounds when the plane is fully loaded. This means that there exists—to fall back on automobile parlance—a large reserve of power. One of the most valuable effects of this characteristic is that although the maximum speed of the plane is so high, it is yet able to land or leave the ground at quite a low speed, making for safety and ease in landing. This low total weight is due to the lightness of the engine in proportion to the power it can develop and sustain.

The Loening plane is one of the first machines designed properly to suit a particular and highly successful engine, also a product of American origin. The 300-horse-power Hispano-Suiza engine as developed in the United States is one of the lightest engines for its power. It easily produces 345 horse-power with a total weight of 600 pounds, including all accessories, and will sustain this power for any time desired under flying conditions. So in the present Loening monoplane the designs, materials, and workmanship are entirely American.

A Horse Ambulance With a Revolving Top

LIKE human beings, horses prefer to ride forward and not backward. Having some consideration for the wounded horses, the designer of the British horse ambulance shown in the accompanying illustration arranged the vehicle with a revolving body or top. Thus the entire body can be swung on its pivot so as to bring the front end to the rear in order to lead the horses down the driveway. Obviously, aside from making it more pleasant for the horses in the two stalls, the elimination of backing the horses down the driveway saves much time and trouble. It will be noted that only the body proper revolves, while the driver's cab remains stationary.



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By means of the revolving top the horses may be led down the driveway from this British horse ambulance

Sectional Pontoon Equipment of the Germans

AMONG the grim jokes of the great war is the fact that the German bridging equipment was employed by Allied troops to far better advantage than by its original owners. For it so happened that the Germans, in preparing for their great drive of July 15th, had provided huge stores of pontoons and other bridging materials, in anticipation of the numerous waterways which they would have to cross on their way to Paris. But on July 18th the tide turned: the Germans were defeated and forced to retreat from the Marne salient, leaving all these bridging supplies behind them. Not only was this a serious material loss, but it actually served to accelerate the Allied pursuit since Allied and American engineers made full use of the bridging supplies in spanning the waterways for the eastward-bound pursuers.

Among the supplies which fell into our hands in a divisional area where United States engineer troops were operating, were enough pontoons and pontoon equipment for about 30 bays of span, 6 pontoon wagons, 2 piledrivers, a large quantity of bridge timber and other miscellaneous bridging materials. The pontoons were of the sectional type shown in the accompanying illustration. In all, about eighty of these boats were finally taken.

In some of their bridging operations it is said that the Germans employed submerged pontoons, with the object of bringing the bridge below the surface and thus reducing the size of the human targets exposed to enemy fire. In view of the difficulties of wading through water with full equipment, and in view of the considerable loss in rapid movement as compared with the slight additional protection gained, it is doubtful if such procedure was intentional.

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One of the sectional German pontoons captured by the Allied troops during the second battle of the Marne

The Vanishing Indian

ALTHOUGH, says the Smithsonian Institution, the total number of "Indians" as recorded by the census increases from decade to decade, this increase is due wholly to that of the mixed bloods; the full-bloods of pure strain are in most localities rapidly disappearing and in a considerable proportion of the tribes have become actually extinct or on the point of extinction. The progress of miscegenation among many tribes seems hardly to have been realized hitherto, even by students of ethnology. A search was recently made for full-blood Shawnees on the Shawnee Agency, in eastern Oklahoma, and for full-blood Kickapoos about McLoud, Okla., where the main body of this tribe is settled. But three of the former were found, and but one doubtful example of a full-blood Kickapoo. "Thus," says the Institution, "two tribes, one of them of considerable importance, may be regarded as lost to science."

The End of the World War

The Final Strategic Moves Which Forced the Surrender of the Central Armies

By Colonel O. B. Mitcham, United States Army

THE present article brings to a close the series of articles "Strategic Moves of the War," which has appeared in the SCIENTIFIC AMERICAN during the great war. When the participation of the United States became inevitable, we were fortunate in securing the services of Col. O. B. Mitcham, U. S. A., and our readers will be interested to learn that for the past two years he has been the author of the series.—THE EDITOR.

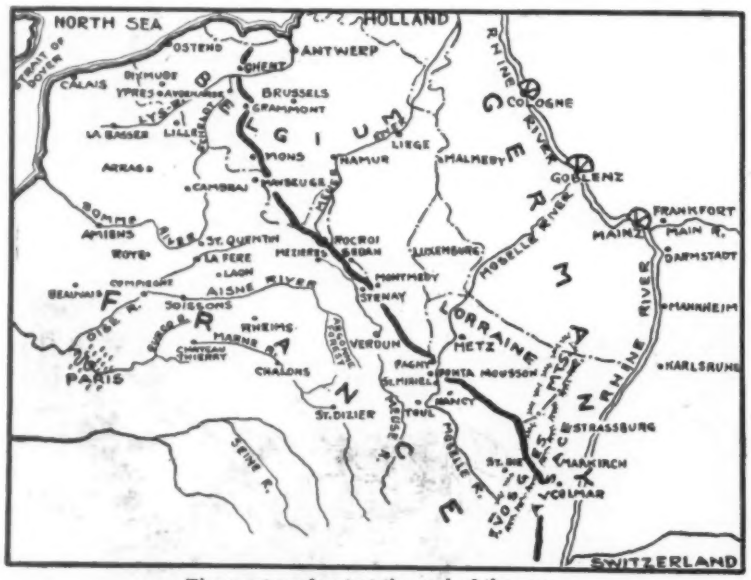
NEVER in present history have there occurred such sudden and complete military reverses as have been the case with the Central Allies during the past four months. Nothing in Napoleonic days, when thrones were falling and entire armies captured or dispersed, has equalled the disasters that have befallen in quick succession the partners in the dreams of world domination who are now doomed to disappointment and to the bitterness of defeat. In July nothing seemed to stand in the way of a partial success or at least of a deadlock with the Entente forces. In November there are no hostile troops in the field except some nominal resistance in Russia and Siberia which will no doubt be quickly overcome. A brief review of the happenings on the various fronts that have led to this remarkable condition may not be out of place to show at a glance the successes of the Entente Allies and the crushing defeats sustained by their opponents.

The Balkan Victories

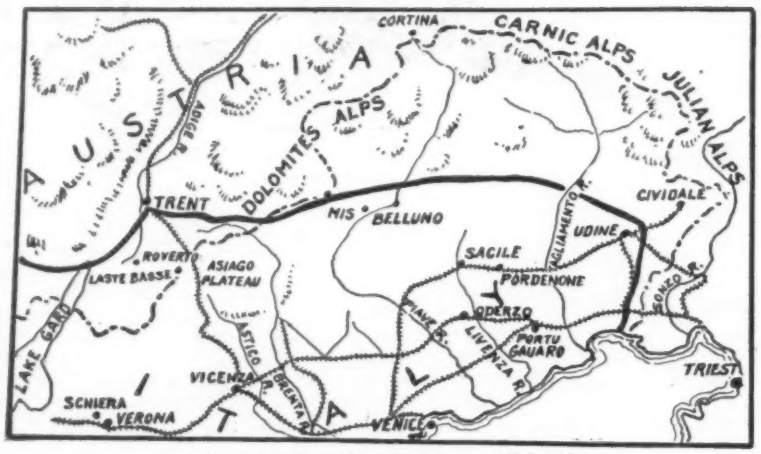
In the middle of September an Allied offensive opened in the Balkans where the Franco-Serbian armies began a campaign by working down the Cerna River from the direction of Monastir into the valley of the Vardar. As the railroad from Salonica to Uskub and Nish follows this valley, its control and that of the railroad meant the mastery of southern Serbia. Aided by the British and Greek troops to the east of the Vardar in the direction of Lake Doiran, the Bulgarians, who had been largely abandoned by the Germans, were quickly thrown back, their left flank to Strumnitza and their right flank to Uskub; from the latter place both Nish and Sofia were threatened. The Bulgarian line was too thin to hold and, when Uskub was reached, it was at once broken; the Serbians and Italians on the Allied left forced the Austro-Germans in the direction of Mitrovitza and northern Serbia while the greater portion of the Bulgarians were driven over their own borders in the direction of Sofia. The Bulgarian defeat was a crushing blow, as their troops suffered great losses and thousands of prisoners were captured; it effectually broke their spirit and rendered them heartily sick of the war—so much so that by the end of September they asked for an armistice and finally made a complete surrender. Bulgaria was the keystone of the pan-German bridge and her collapse would necessarily be the undoing of Turkey. But the latter had already met her fate in the east.

The Defeats in Palestine and Mesopotamia

When the movements of the British troops ceased last spring after the capture of Jerusalem, they occupied a line about fifteen miles north of the city extending from the Mediterranean to the River Jordan. Not only were they opposed on the west of the river by Turkish and German forces but the Turks had massed troops on the east bank to prevent any drive along the railroad in the direction of Damascus. Just at the time of the Balkan advance, the British commander attacked the Turkish right wing nearest the sea, breaking through and moving first north and then east. By this means the entire wing was surrounded and practically annihilated. On the east side of the Jordan the Arabs of the Hedjaz, assisting the British, cut the railroad at the railway junction of the line from the seacoast at Haifa with the road running to Damascus. The Turks on both sides of the Jordan were thus trapped and defeated with the loss of two entire armies; the road to Damascus and to Aleppo was wide open to the British forces with convenient bases of supply on the Mediterranean. By rapidly following up their success, Damascus was taken by the British on October 1st and Aleppo was occupied October 26th; the latter city, being the junction point of the railroad from Constantinople with the roads running south to Palestine and east to Mosul, was the base of supplies for the troops in both sections. Its fall therefore placed the Turkish troops in the Euphrates and the Tigris districts in a more or less precarious position and in fact ultimately led to the disastrous defeat of the Mesopotamian army and to the capture of Mosul. The entire Turkish army in that sector that had been opposing the British was captured on October 21st and Mosul was entered the same day. The Allies were therefore in a position to do what they would in Turkish territory, for the Turkish armies were all practically eliminated and Turkey was doomed beyond recovery. An armistice was concluded by the latter with the Allied powers on November 1st; by this she was stripped of all power, and she practically placed her territory at the disposal of the Allies and opened the Dardanelles to the Allied fleets. The road to Constantinople had been closed to the Allies for the four years of the war, though Gallipoli came near putting it in their power to reach the city. The new route via Jerusalem, Damascus and Aleppo had been more fortunate and—when Aleppo fell—the Turk knew the end had come and that Constantinople would be forced to surrender. All these results in the Near and Far East would have astounded the world a year or two ago; later they were only the usual incidents to the insane German struggle for world power and conquest.



The western front at the end of the war



Where the Austrian army was annihilated

The Italian Successes

Many changes had taken place in the Italian army since its defeat at Caporeto last year; it had been thoroughly reorganized, the number of guns had been doubled and the soldiers better supervised and fed. The moral, as well as the physical effect, was soon apparent and her army quickly showed that it could make a good comparison with that of any other nation. Following up the Allied successes in other fields the Italians began on October 25th and succeeding days an advance both on the left flank toward Monte Grappa and the Asiago plateau and also on the right wing along the Piave River. They were soon across the latter and began at once pushing the Austro-German forces back toward the Tagliamento and Isonzo Rivers, for the favorable moment for the advance had come. In Albania across the Adriatic the Austrians were already giving way before the Italians and in Serbia, they had been beaten back to the Danube and were endeavoring to strengthen their lines there by troops taken from the Italian front. The Germans on the defensive throughout the French front could spare no men for service in Italy; in fact the Austrians had been called upon to reinforce the Metz sector. While the initial advance on the north toward Trent was only a feint, the true object was to drive the Austrians over the Isonzo and out of Italian territory; the latter were too weak to hold back the Allies and began a retreat that ended in a rout before the Isonzo was reached. The eastern armies were soon separated from those on the north and a disorganized flight was the result. By the time an armistice was declared on November 4th, the Austrians had fled beyond the Tagliamento and even Udine was being evacuated. The Italian troops swept forward from the mountains all the way to the sea and by the time hostilities actually ceased, they had taken three hundred thousand prisoners and five thousand guns, together with enormous supplies of military stores. The victory put an end to Austria as a belligerent power and was the decisive element in bringing the war to a close, so far as that country was concerned. The final results were that the Italians had practically gained at the time of the armistice the two main military objectives for which they entered the war. Triest became at once an Italian port and Italia Irridenta became free to ally itself with Italy, with which country a common language and common interests had always bound it fast, even though under Austrian domination. In the north Trent and the valley of the Adige were the keys to northern Italy and, in Austrian hands, were always styled a

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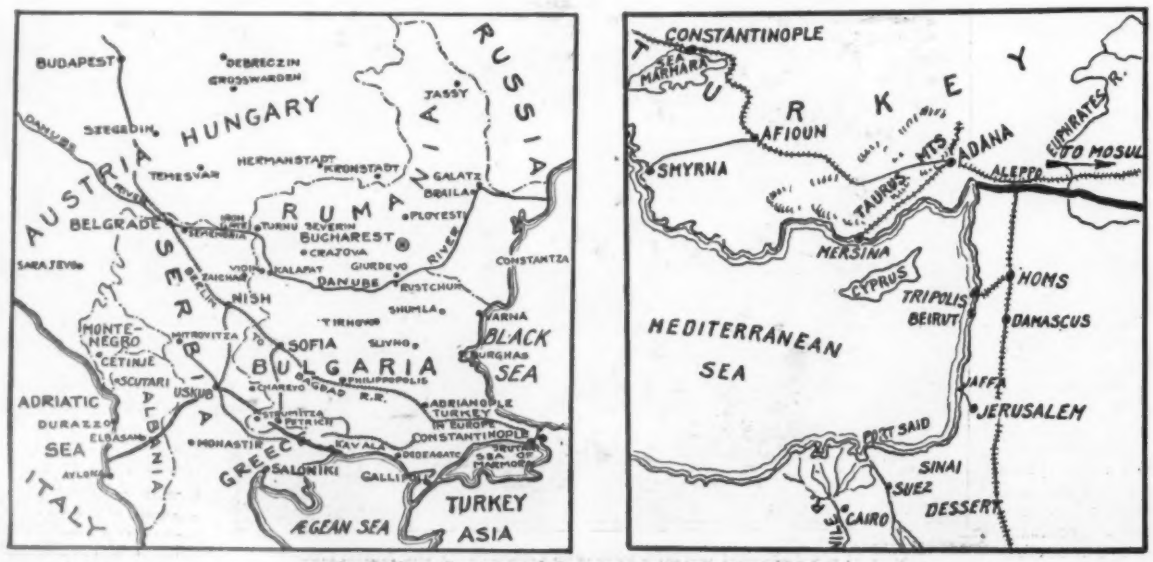

The Balkan theatre and the scene of Turkey's collapse

The Needs of the Patent Office

Outstanding Weaknesses of the Present System of Handling Inventions

By Thomas Ewing, Ex-Commissioner of Patents

THE Patent Office should have the support of all classes of people without regard to their opinions about the patent system. For it is the function of the office to eliminate all patents which under the statute ought not to be granted.

No sincere worker at invention wishes to obtain a patent to which he is not entitled. On the other hand, the public is greatly interested in the prevention of grants that are unwarranted either because the disclosure does not constitute an invention or because the claims are too broad.

Of course, we might have a mere system of registration under which an inventor or his attorney prepares an application for patent in the form in which he desires it and obtains the patent on the payment of the required fees. This was the system which we had in effect down to 1836 and which is in vogue in certain countries today. Under such a system the mere grant of the patent raises no presumption in its favor.

But where as with us an office of respectable standing and considerable size undertakes to pass upon the patent, the Courts very properly give weight to the fact that it has been so passed upon. To maintain a system of grant on examination without making adequate provision for examination is therefore obviously unwise. Yet this is what we are doing and conditions are growing worse.

The trouble lies with Congress and the business man can help and should help to influence Congress.

It is comparatively easy to get increase of force which can be defended by merely counting items. Thus the examining corps of the Patent Office has been increased in about the proportion of the number of applications filed per year. But the correctness of such a rule is based upon two assumptions, first, that there was adequate provision to start with, and second, that the work per application is not increased. Neither of these assumptions is true.

When I was in the Patent Office as an Assistant Examiner 30 years ago, the force was inadequate to the work. Forty thousand applications were filed per year, and every man on the force was obliged to handle about two hundred applications, each Principal Examiner passing upon about fifteen hundred per year. This is more than any man can do properly if the applications are of average difficulty.

Yet this is about what is required today as it was 30 years ago. The relation of the personnel to the number of applications is practically stationary.

But there is vastly more literature to examine today than there was 30 years ago, and it is therefore more difficult to make a proper search. Careful calculations as to force and number of applications and the extent of the literature to be searched through have been laid before Congress showing that the force today relatively to the work it has to do is about one-half of what it was 30 years ago, but without producing any effect on Congress.

The trouble just at present is partly that the party in control, to which I belong, is drawn mainly from sections of the country where few inventors reside; but taking the country as a whole only one application is filed to about fifteen hundred people or say three hundred families each year, and the number of patents granted is about one to every 500 families. Therefore, there can never be any considerable political influence exerted in favor of the Patent Office. The influence must be drawn from manufacturing industries.

The office needs today an appropriation of about one million dollars beyond what it has. It is receiving two million dollars and could use three million dollars to great advantage. Six hundred thousand dollars of the additional million dollars should be spent in increases in personnel in the examining corps and the clerical force, and three hundred thousand dollars on increase of salaries.

It is perfectly clear that the office can never get for itself any such increase in appropriation. The last year when I was Commissioner, I asked for an increase of one hundred thousand dollars and was not allowed one penny until we entered the war when I succeeded in making such an appeal, based on the importance of prompt action, that they granted a small increase. Unfortunately, the depletion of the force by enlistments and the draft and the impossibility of filling the places made the additional appropriation when it came practically useless.

But an increase of $40,000 wrung from an appropriation committee on the request of $100,000 and where a million is needed is sufficient to illustrate the insurmountable character of the obstacle which the Patent Office faces.

On the other hand, Congress does respond to well directed appeals from the outside, and could be brought by the business men of the country to listen to the demands and supply the needs.

Salaries are altogether too low. The Primary Examiner, who has authority to pass on patents of inestimable and frequently of very great value, receives a salary of $2,700 a year. A very large majority of the men are graduates of colleges and technical schools, yet their children may not be properly educated as the salary will not permit it. Some of the men are of exceptionally fine ability, but on the whole the work suffers seriously because of the inadequate compensation, and what is true of the Primary Examiners is equally true of the First and Second Assistant Examiners, many of whom have been in the office a long time. After they have learned the classes their value to the Government is very largely increased as time goes on and they should be paid enough not only to keep them in the service but to enable them to live in comfort and bring up their families according to their own educational standards. Men higher up in the office who hear appeals are also inadequately paid, but the importance of increasing their salaries is not so great as in the case of Primary Examiners and the higher grades of assistants.

The library should be greatly enlarged and adequately manned. Congress allows three thousand dollars a year with which it is supposed to keep up all the great technical literature of the world including both periodicals and important books. The amount is ridiculously inadequate.

It ought to be true also that the Examiners and their assistants could go to the great manufacturing centers and study actual practice. This could easily be accomplished by permitting private concerns to pay traveling expenses, but it has been deemed inadvisable to put the Examiners under such obligation. Congress provides a fund of $500 which can be divided up among something over four hundred men for this purpose. It should be $50,000 with more to come if found desirable.

There is one fundamental difficulty which I fear can not be overcome under present conditions, viz., the demands of the office are brought into comparison

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Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

A Universal Alphabet

To the Editor of the SCIENTIFIC AMERICAN:

About eight or ten years ago, or even fifteen, the SCIENTIFIC AMERICAN SUPPLEMENT published an article of about a column in length on "An Universal Alphabet." It discussed the desirability of a world alphabet that would be a scientific standard of sounds of human speech as much as the metric system is of dimensions, weights and measures. The article attracted some attention and was reprinted in full in a pamphlet sent out from Boston University some years later, urging an international conference to formulate a standard alphabet. The International Phonetic Association, with headquarters at Paris, and sub-heads at London, and perhaps in Germany (till the war) has urged a similar course for many years. At the present time, with the attention of all persons directed to world-problems, it should be an opportune time to call attention to such an important matter as this.

It is undoubtedly possible for scholars and others to agree, at least approximately, on the sounds of human speech as made and used in the various languages and dialects of mankind. It is also possible to adopt certain signs for such sounds, and to establish an unchangeable rule that each sign shall represent but one sound, and that every sound shall have one and only one sign.

Such an alphabet could be wrought out wholly new on some scientific principle, perhaps, like Bell's Visible Speech. Or it could adopt certain of the characters now in use in some one or more of the many written languages of the world. Of course, no language contains every sound that is employed in human speech, and consequently none has an alphabet that will stand for all sounds of the human vocal organs. But selections could be made from the different written tongues, living and dead.

Several times, bills or resolutions have been offered in the Congress of the United States, providing for calling such a phonetic conference in Washington, and directing the President to name delegates with certain appropriate qualifications, and to invite the sending of delegates from all other nations and peoples, so that if possible, every form and variation of human speech may be represented in such conference.

With a new after-the-war era opening, and a promise of greater intercommunication of mankind than ever, a scientific alphabet would be of inestimable value. Its first use would be as the standard of speech-sound, and hence it would serve as the proper "key" to pronunciation of every language, either for one's mother tongues (as in English and French where pronunciation cannot be unerringly known from the spelling), or for the study of foreign languages. At present, every bilingual or polyglot dictionary has to preface a key to pronunciation of the several languages, or at least for the language which the user of the dictionary is least familiar with. As all students of language know, this means innumerable keys. Usually the comforting assurance is added that the indication is only an approximation, and the correct sound *must* be learned from a native or from a teacher. With a scientific alphabet it would be possible for every thorough student to learn such alphabet accurately so as to know every sound used by mortals in uttered speech. And for dictionaries of English, nearly every one knows that there are a number of "keys" to pronunciation, used by Webster, Standard, Century, and other dictionaries, and that some of these are "improved," or at least changed a little, at every extensive revision of the text. A scientific alphabet would be a permanent key for all dictionaries, except in so far as they desired to make very fine shades of distinction for the very particular.

MAJOR J. C. RUPPENTHAL.

Washington, D. C.

The Weather and the Epidemic

To the Editor of the SCIENTIFIC AMERICAN:

In the November 16th issue of the SCIENTIFIC AMERICAN you state some questions aroused by the present visitation of Spanish influenza, the disease of mystery.

I believe the answer to some of these questions is to be found in the unusual weather conditions of the last two years.

Over this section in the last two years, both winter and summer, and I believe over the United States and the rest of the world, there has passed an unusual number of high pressure areas—areas of descending air currents. The air of these descending air currents is cold and dry, and on being heated, its capacity for absorbing moisture is increased. When it then comes in contact with the skin or enters the lungs, it might readily make these tissues raw and rough in comparison with their normal state, and consequently more susceptible to germ attack.

Also, the drying out of all moist surfaces, which are probably the habitat of myriads of germs, would turn loose into the air immense numbers of germs to find new homes on any moist surface they may come in contact with. A very likely place would be on or in the human body.

The descending air currents operating on a great variety of factors would explain the erratic character of the influenza, as well as its periodicity. For the highs as well as all other general weather conditions vary with sun spot frequency, which is periodic. As the meteorologists seem to be having some measure of success in making long distance weather predictions, it seems quite possible, that in the future, we will be able to make long distance predictions as to influenza recurrences.

WM. CROCKER.

Prescott, Ariz.

Reckless Statements

To the Editor of the SCIENTIFIC AMERICAN:

I wish to add my O. K. to Mr. Colles remarks on the questionable cotton picker as tending toward the unreliability of statements made by persons that do not know how to measure up mechanical and commercial efficiency. I have had occasions to write to references furnished by different makers of gas tractors and well boring machinery, and have yet to hear from one who knew exactly what he was recommending. Many of the replies came from agents of the goods recommended and others came from purchasers of goods who were promised commission on goods sold on their commendation. On two occasions I wrote to bankers, whose names read big to my mind, but who turned out to be strictly absent landlords. How the SCIENTIFIC AMERICAN escapes with only an occasional questionable article getting by its editors speaks for its great reliability and doubtless accounts for the fact that most of its elderly buyers and subscribers began to read it in youth.

WALLACE D. MOORE.

Alameda, Cal.

To Our Subscribers

WE are nearing the close of another year—the seventy-fourth of the SCIENTIFIC AMERICAN's life. Since many subscriptions expire at this time, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

Concerning Cotton Seed

The Position Which This Former Waste Product Holds in the Industry of Today

Photographs Copyright Underwood and Underwood

ALL oils and fats susceptible of large production are becoming of double interest on account of the urgent temporary need of them for explosives, for engine fuels, for lubricants, and for the feeding of humans and animals. The simpler the composition of such an oil the more probability of its wide availability in the industries of war and peace, since a neutral oil, lacking strong individual character, is the more readily convertible to different purposes. If an oil is found meeting this description, and at the same time occurring as a by-product of another manufactured article which is itself required in enormous quantities, we have obviously an industrial agent of extraordinary promise, and one to which we must give every attention.

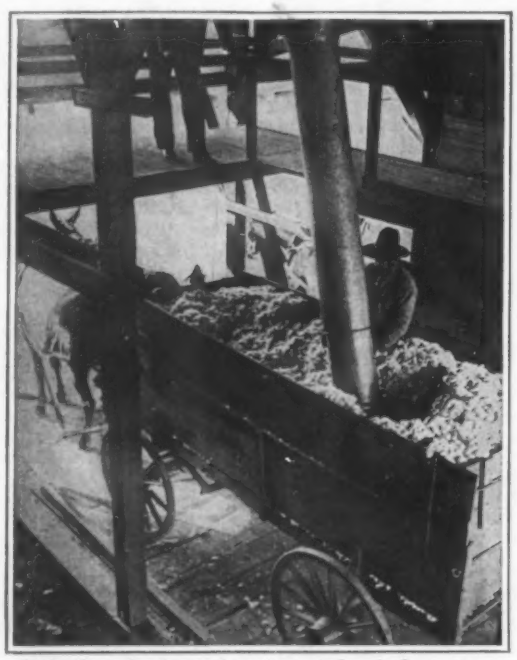
It is this combination of factors which is impelling the recognition of cotton-seed oil as something of far more consequence than a mere substitute. Rather, it is now coming more and more to be regarded as a basic oil from which almost all the fatty products needed for specific purposes may be obtained by synthetic compounding or other means.

The ease with which the cotton-seed oil may be refined to any desired degree is at the bottom of these possibilities for turning it into a universal or standardized oil base.

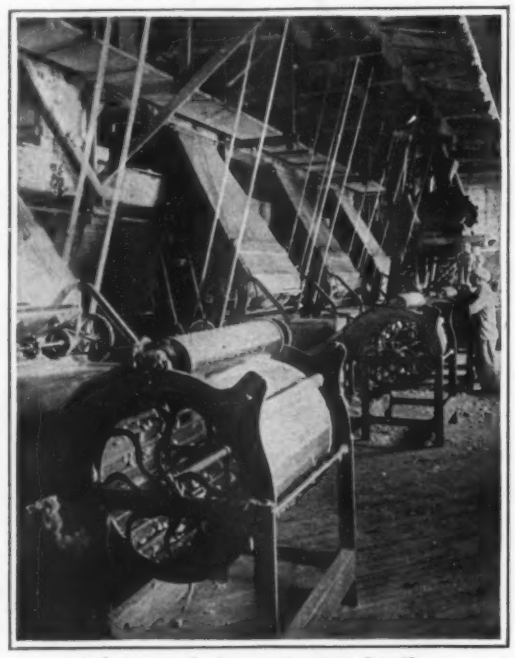
The actual uses to which cotton-seed oil is now being put cover a wide field. The bulk of the production is employed as butter oil for margarine and as compound lard. For both these purposes it is unrivalled. Another grade to which a well known trade name is applied is used largely by bakers for shortening. It is often mixed with tallow or cocoanut oil to form the base of soap manufacture. Undisguised it finds wide employment in salad oil, mayonnaise preparations, and as a sardine vehicle. Much of the progress made by chemists to render it undistinguishable from olive oil is naturally still veiled. Dissolved in light mineral oils it has taken the place of lard oil as a lubricant, with improved results.

One of the possibilities of cotton-seed oil which intrigues the imagination is its employment as a lubricant for aviation engines in place of the more usual castor oil. It has been ascertained that cotton-seed oil acquires the density and viscosity of castor oil when air at 100 degrees Centigrade is blown through it; but no test records seem to be available to show whether such blown cotton-seed oil is in other fundamental respects sufficiently similar to castor oil to take its place as the preferred lubricant for extreme temperatures, high and low. The inflammation point and the scale of variation of the viscosity at different temperatures would here constitute the main points at issue. But as certain blown mineral oils which figured in French engine tests of eight or nine years back were considered by some of the judges to be equal or superior to castor oil, and as the main objection to their use was at that time stated to be the cost of the blowing process, there is good ground for believing that a cheap method of blowing cotton-seed oil might afford a short cut to the same results that are now being sought through extensive cultivation of the castor bean.

In all these matters economy is a vital factor, and this is intimately associated with the other uses that can be made of the cotton product, and the consequent reasons already existing for enlarging cotton cultivation. Directly connected with the war situation, the advantages of cotton seed flour for bread are finally attracting deserved attention. The flour from cotton seed contains five times the protein of wheat flour, but practically no starch. The composition runs from 49 per cent combined protein and fat to 60 per cent protein plus 10 per cent fat. On the merits of the situation, one authority maintains that 20 per cent of the protein we consume should come from cotton seed. It may here be mentioned that in a boll of cotton one-third of the weight is fiber and two-thirds seed, and that of the seed 40 per cent is hull and 60 per cent kernel. The kernel, or meat, holds from 18 to 24 per cent of oil, exceptionally as high as 35 per cent. When the oil has been pressed off the seed cake, there remains, under the latest American methods, 6 to 7 per cent of oil or even less; and from the seed cake with this oil content the cotton seed flour for human consumption is prepared, the cake being first ground into meal. At baking experiments in London the best results with this flour were obtained by mixing 25 per cent of the cotton seed flour with 69 per cent of wheat flour and 6 per cent of potato flour. Bread baked from this mixture contains, when the moisture amounts to 25 per cent, 16.9 per cent of protein, equalling in this respect the best steer meat, aside from the miscellaneous alimentary values derived from the wheat and potato ingredients.



Unloading the farmer's cotton at the gin by means of a suction pipe



A battery of gins separating the fiber from the boll

The more customary uses of cotton by-products will appear from the following brief resumé of the outstanding facts in connection therewith. Out of the world's annual cotton crop of about 21,000,000 500-pound bales and 10,000,000 pounds of the seed, all but some 5 per cent is of the variety known as American, Upland, Indian, or Bombay, and referred to as rain-grown, in distinction from the Egyptian irrigation-grown variety. The fiber of the latter is all long staple, and the smooth black seed is designated as bald or black. This seed has always fetched a price from $10 to $15 per ton higher than the American seed, and the seed-cake something like $7.50 more than American seed-cake—speaking in both cases of cake that includes the hulls or shells of the seed. In the American variety the seed is white, getting this color from a short-fibered, woolly coating of cotton lint which runs 20 pounds to a ton of seed. This fiber has become of special value as the best material from which to make guncotton, artificial water-resistant silk, tissue paper, and the acetate cellulose employed for the "dope" or varnish of airplane wings. Large quantities of this short lint adhering to the hull of the American cotton seed have been turned to account by the big powder companies here.

Up to 1860 cotton seed was almost a waste product in America and hard to dispose of, being similar in that respect to many other chemicals which now serve a useful end. Planters were prohibited by law from stacking it near the gins, because of the fire risk; nor were they allowed to dump it in the rivers, since it affected fish life detrimentally. After sufficient had been set aside for the next year's seeding the rest was therefore usually burned. When oil mills were first established the seeds were pressed with the hulls, and the press cake, which naturally included the short lint, was used for fertilizer. Later this cake was fed to cattle; and it was then found that their manure retained from 80 to 90 per cent of the fertilizing properties of the meal. The oil mills eventually set up machines to remove a portion of the adhering lint before crushing the seed and forming the seed cake. By this means not only was the lint recovered for use, but the quality of the delinted press cake as cattle feed was found to be much improved over the older lint-bearing product. The delinting machines are similar in principle to the gins employed by the planters for removing the long cotton fiber from the bolls. The mechanical elements are minute revolving saws to cut the fiber, brushes to sweep it into a flue, and a fan to drive it into a condenser—a revolving cage of wire cloth on which the lint collects in the form of a roll, to be removed by hand as required.

It has finally become the American practice to

(Continued on page 507)

Preparing trays of cotton seed for the presses

The oil presses at work, with the oil flowing at the left

Feeding the cake from the presses into a crusher

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1. Surrendered German submarine. 2. Latest dreadnought, "Bayern," 28,000 tons. 3. Latest battle-cruiser, "Hindenburg," 28,000 tons. 4 and 5. German destroyers in column. 6. Distinguished group aboard U. S. S. "New York," at the surrender of German fleet. Left to right: Admiral Beatty, R. N., Admiral Rodman, U. S. N., King George; Prince of Wales; Admiral Sims. 7. U-boat commander signs declaration his vessel is O. K. as he hands it over to British officer. 8. One of the largest U-boats, mounting two 5.9-inch guns. Note the range-finder on conning tower, the wireless and cables for deflecting nets. 9. Three U-boats with crews, waiting to enter Harwich for internment.

SNAPSHOTS OF THE GERMAN SURRENDER

The Service of the Chemist

A Department Devoted to Progress in the Field of Applied Chemistry

Conducted by H. E. HOWE, Chemical Engineer

Some of the Rarer Metals—A Pot Pourri

ONE of the earliest observations of men was that the earth is composed of different substances although a simple subdivision into earth, fire and water satisfied the requirements for a very long time. With the progress of knowledge came more diligent inquiry until in the days of alchemy a number of elements were known and a system of symbols had been adopted to prevent the necessity of frequent repetition of the words. This convenience was probably original with the Arabians with whom it is said our plus and minus signs also had their origin. We now know that many materials which were thought to be elements were but mixtures of two or more substances, each of which has definite characteristics entitling it to be considered an element of the earth's crust.

About eighty-four such elements or building stones have been identified to date and of these the following twelve, according to Dr. F. W. Clarke, compose 99 per cent of the earth as we know it, including the atmosphere and water:

Oxygen	49.85%	Potassium	2.33%
Silicon	26.03%	Magnesium	2.11%
Aluminium	7.28%	Hydrogen	0.97%
Iron	4.12%	Titanium	0.41%
Calcium	3.18%	Chlorine	0.20%
Sodium	2.33%	Carbon	0.19%

The remaining 1 per cent is, therefore, made up of some 72 different kinds of matter and it is not difficult to understand that some are rare. However, the mere abundance of an element *in combination* with other elements does not necessarily remove it from the class of rare elements in a pure state for industrial uses. For example, previous to the work of Hall, aluminium was so difficult to prepare as a pure metal that it sold for at least $250 per kilogram in 1866 while as late as 1883 the whole production was only 40 kilograms. One of the important problems still unsolved is the economical, commercial production of aluminium from common clay.

Consider, also, potassium, which is to be found in large quantity concentrated in our feldspars, alumites and even certain lakes, yet so far as an American source is concerned it may be considered a comparatively rare element.

It sometimes happens that a metal remains a rarity because no one has found commercial application for it and in the absence of an active demand the quantity produced is below that at which a reasonable cost may be realized. This also, at times, is the greatest hindrance to the discovery of commercial uses for the price is a barrier to experimental work. It is like the spider which must have a new web in order to obtain food and yet needs to catch a fly before he can spin the web.

In the list of the less familiar metals we may write Barium, Bismuth, Cadmium, Caesium, Cerium, Cobalt, Columbium, Gallium, Germanium, Glucinum, Indium, Iridium, Lanthanum, Lithium, Molybdenum, Osmium, Palladium, Rhodium, Rubidium, Ruthenium, Scandium, Selenium, Strontium, Tantalum, Tellurium, Thallium, Thorium, Titanium, Tungsten, Uranium, Vanadium, Yttrium and Zirconium. So far as real acquaintance goes some of us could add gold, platinum and radium!

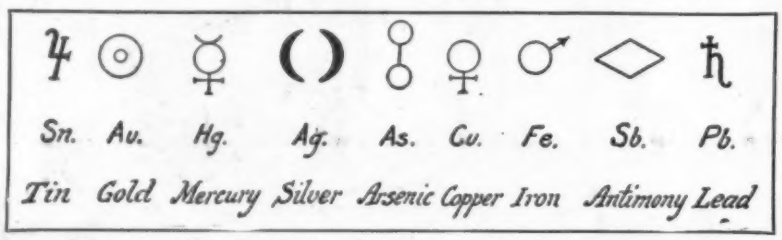
Metallic *Barium* is silver white and may be made from the molten chloride by electrolytic methods. It has a specific gravity of 3.75 and melts at 850 C. The metal has but recently assumed commercial importance, an alloy having been devised that resists acids especially well and is, therefore, in demand in chemical industry. Barium salts have long been staple articles of trade, the precipitated sulphate being used in paper fillers, paints, etc. The sulphate together with zinc sulphide is treated to make "lithopone" widely used as a paint pigment having several advantageous qualities. The chlorate of barium is an ingredient of green fire, while the peroxide is the basis of one method for the preparation of oxygen from the air and is used in making hydrogen peroxide.

Bismuth, specific gravity 9.747 and melting point 268° C., is one of the few substances which expand rather than contract upon cooling. It is a shining metal with a reddish cast and does not tarnish. It is brittle, but finds wide application alloyed with lead, tin and cadmium to form low melting point solders and fuses for fire extinguishing sprinkler heads. Boiler plugs are sometimes made of such alloys, casts of objects liable to injury by high heat are made and tempering baths of fixed and special temperatures may be made with them. This alloy, made with 25 parts of lead, 12.5 of tin and of cadmium and 50 of bismuth, has a melting point of only 55.5° C. This can be raised by degrees, by changing proportions, to 173.8° C. for which 67.8 parts of bismuth and 32.2 parts of cadmium are required. Above that lead and tin are used in various amounts giving melting points up to 200° C. Bismuth is sometimes used in special electric fuses to protect delicate instruments in the circuit and in stereotype metal where very clear impressions of the type are required. It is also used in silvering certain mirrors, in dental amalgams and its compounds find application in staining glass, enameling, porcelain painting, face powders and medicinal preparations. It is highly prized for surgical dressings.

Cadmium is white and more malleable than zinc in the ores of which it occurs as an impurity. Much cadmium is sold in zinc where it is objectionable for certain purposes. But cadmium may be distilled from zinc and the fact that it is not constitutes one of our mineral wastes. Cadmium is also wasted in coal-fired brass furnaces. The metal is like lead in appearance, has a specific gravity of 8.64 and melts at 321° C. Its principal use at present is in fusible alloys and in glass manufacture although it has been said that a new, secret military use has been developed. Some plating is done with a silver-cadmium alloy and if we saved all the cadmium we could its price might become low enough to encourage the use of cadmium sulphide as a yellow pigment. It has been demonstrated that our tin may be conserved by the use of cadmium, to a certain extent, in its place in solder. Germany has used such solders extensively during the war.

Caesium belongs to the group of rare elements and the metal has no extensive commercial application. It derives its name from the two blue lines which it produced in the spectrum observed in that of the materials in a certain mineral water. It has a specific gravity of but 1.87, melts at 28.45 and boils at 670° C. Its salts or compounds resemble those of potassium.

Cerium was a waste material six years ago constituting 30 per cent of the by-product from thorium production. One per cent was used together with 99 per cent of throria in gas mantels and the sesquioxide was used somewhat in developing aniline black on textiles. Since then pyrophoric alloys have become prominent. These contain about 70 per cent cerium and 30 per cent iron and find use in automatic lighters for miners' safety lamps, lanterns, cigar and other lighters. Besides the grade which produces sparks upon attrition a special alloy giving a solid flame may be made. Cerium oxide is very infusible while the fluoride finds application to some extent in flaming arc electrodes, producing a yellow light. Specific gravity, 6.92; melting point 635° C.



Alchemic symbols (first line) and present symbols of chemical elements

Cobalt is found with certain Canadian silver ores and in some nickel ores. It is silver white, has a specific gravity of 8.718 and does not melt below 1478° C. Its use in the quantity necessarily produced has constituted a problem for some time and a prominent text printed this year states that there are no commercial uses for cobalt. Fortunately, this is not the case and as a component of a cobalt-chromium-tungsten alloy, cobalt has played a part in winning the war. This alloy is more efficient even than tungsten steel as a cutting tool and since it will both hold a fine edge and not tarnish it has wide application in surgical instruments and domestic cutlery. A successful method for electro-plating with cobalt in place of nickel has been perfected, but the necessary use of cobalt for war purposes interfered with the manufacture of cobalt electrodes and it is hoped development may now proceed. The indications are that cobalt will plate more rapidly than nickel and that a thinner film will afford equal protection. The possible time saving is obvious. Cobalt oxide is used to impart the beautiful, characteristic blue to glass bearing the name and is relied upon for a pretty blue as well as to neutralize the yellow of titanium in china and porcelain.

A metal melting at 1950° and with a specific gravity of 7.06 is *Columbium* at one time called *Niobium*. It has no commercial significance and comparatively little is known about it.

Prices of $21 and $75 a gram can hardly be expected to lead to extensive use. These were the prices of *Gallium and Germanium* a few years ago. Gallium is named for France where it was discovered with the aid of the spectroscope. The respective specific gravities of these metals are 5.95 and 5.469; their melting points 30.15° and 916°.

Glucinum derives its name from the sweet taste characterizing ts compounds. It was formerly called *Beryllium* since it occurs in beryl which, when tinted given by the silicate of chromium, is known as emerald. The metal resembles magnesium in many ways, but is not used in its metallic state, the nitrate being most in demand. Its specific gravity is 1.85 and the melting point 1280°.

One of the rare elements of the aluminum family is *Indium* which occurs in zinc-blende. It has a specific gravity of 7.12, melting point 155° and boiling point 700° C.

In *Iridium* we have a useful, rare metal. In crystalline form its gravity is 22.42 and melting point 1950°. In spongy form this point is 2250°. It resists acids, even aqua regia, and is harder than platinum. It is, therefore, widely used to impart its qualities to platinum alloy which may then be drawn and worked to much better advantage. Iridium is also alloyed with osmium. Iridium alloys are used in high grade watches and compasses while the iridium crystals are employed as points on the better gold pens. This process involves fusing the crystal in place after which the pen is slit and pointed.

Lanthanum is not commercial. It is one of the by-products in thorium production and its separation from the other elements with which it occurs is quite difficult. Its melting point is 810° C., its specific gravity 6.15.

Lithium is closely related to sodium and potassium and is best known for its application in medicine since its carbonate is a solvent for uric acid. It is a soft silver white metal with the lowest gravity, 0.534, of any metal. It will, therefore, float on water and also petroleum in which it is kept to prevent rapid oxidation. It melts at 186° C. and assists the fluxing or flowing of glass. When burned, the compounds of lithium give a bright red flame.

Ductility and a melting point of 2500° C. are largely responsible for the utility of *Molybdenum*. Its specific gravity is 10.281, and it has been a competitor as ferro-molybdenum with ferro-tungsten. It imparts the same qualities to steel when used in one-fourth the quantity, but has the disadvantage of volatilizing from steel very readily. Ways have been found, however, for lining gun barrels with molybdenum steel which greatly increases the life of the weapon. Ability to resist shock makes such steel desirable in many designs. Metallic molybdenum is a valuable element for resistance furnaces and it is also largely used as a support for the tungsten wire filament in electric lamps. The metal is prepared by reducing the oxide in hydrogen after compressing it into shape. The metal powder thus secured is then sintered together by the passage of a powerful electric current, the resistance to which heats the metal to the desired temperature. The bar thus formed may then be rolled, swedged, etc. Molybdenum-nickel steel has excellent elongation and is very hard and has been used for armor piercing projectiles. Some molybdenum compounds give a fine blue for pottery and for dyeing silks and woolens.

Osmium is very rare and aside from the alloy with iridium, to which reference has been made, finds little use as a metal. Experiments indicate that it might be an excellent catalyst for several important reactions such as ammonia synthesia if it could be had in quantity. Its compounds, notably the oxide, are very useful in histology. Osmium is the heaviest of metals having a specific gravity of 22.48. Its melting point, 2700° C. is only exceeded by that of tungsten.

Palladium possesses the lustre of platinum and the hardness of steel. The element was named from Pallas, a planetoid and is well known for its ability to absorb hydrogen. Deposited on asbestos, it is used as a catalyst. Its melting point is 1550° C. and the specific gravity between 11 and 12. The inner mechanism of fine chronometers is often palladium or an alloy of palladium which is also used in surgical instruments. Palladium and gold have been alloyed to form a substitute for platinum and it serves well for some work. For instance a portion of the mural circle at Greenwich is of this alloy.

Rhodium belongs to the same group and is closely related to iridium. With it an excellent platinum substitute has been made. Being harder than platinum and uneffected by aqua regia, it is frequently alloyed with it. Platinum-rhodium alloy is often used as one of the members of an electro-thermo couple for high temperature measurements. It melts at 1970° C. and has a specific gravity of 12.1.

Rubidium, *Ruthenium* and *Scandium* are chemical curiosities thus far. Their specific gravities are given as 1.53, 12.26 and that of the third is undetermined. The melting points are 39°, 2,000° and 1200° C. They have no commercial usefulness.

For some time *Selenium*, gravity 4.26-4.8, depending on its form and melting point 50°-217° C., was also useless. It has been found that selenium may be added directly to a pot of molten glass to produce a beautiful rose color while a deep orange red may be produced when cadmium sulphide is added with selenium. More important still is the use of a selenium compound as a decolorizing agent in glass in the place of manganese dioxide. This is a result of the war which cut off Turkish supplies and now the results are obtained with less cost than was formerly possible with manganese. Nearly all sand contains enough iron to impart an objectionable green color to glass made from it, but these decolorizing agents form a colorless compound with the iron in the glass. In time, under certain light conditions, glass bearing such decolorizers may assume a tint, manganese for example producing a purplish cast.

A unique characteristic of selenium is that light will

(Continued on page 508)

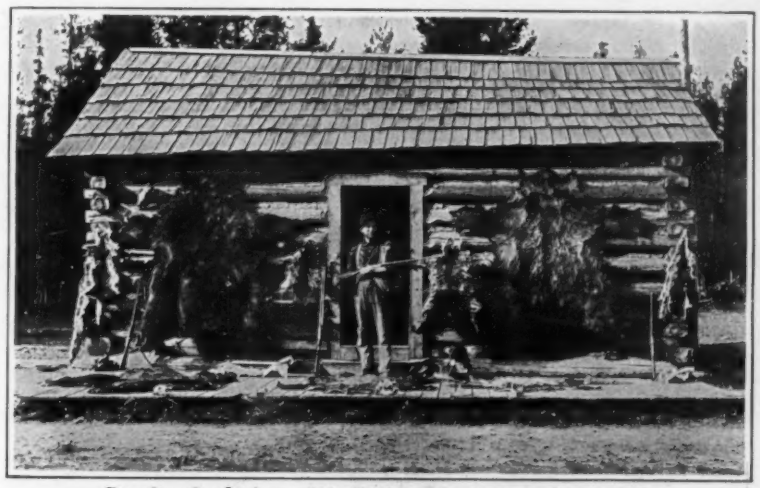
Freeing the Range of Predatory Rogues

SKILLED hunters in the employ of Uncle Sam are waging persistent warfare against the predatory animals that prey on sheep and cattle in the Western States. Their efforts are encouraging stockmen to increase live-stock production on the Federal forest reserves as well as in the range country, and they are protecting the sources of war supplies of meat, leather and wool now in the western grazing districts.

Hunters of the Biological Survey of the United States Department of Agriculture have killed 70,713 predatory animals during the last three years, which has resulted in a direct saving estimated at nearly $5,500,000 a year to the stockmen of the Rocky Mountain section. The total kill since the fall of 1915, when the work was started, includes 60,473 coyotes, 8,094 bobcats, 1,829 wolves, 201 mountain lions and 137 bears. The Government experts estimate that the annual depredations among cattle and sheep effected by single predatory animals are as follows: Wolf, $1,000; stock-killing grizzly bear, $500; mountain lion, $500; bobcat, $50; and coyote, $50.

Stockmen in sections where the predatory animals are obnoxious are aided by the Government in ridding the ranges of such rogues. In some localities the stockmen's associations coöperate with the State and Federal authorities in the extermination campaign, professional hunters being employed to detect and kill the prowling animals that prey on sheep and cattle. Illustrative of the scope of this work, the total income from pelts of predatory animals killed by Government nimrods last year amounted to approximately $100,000. In addition many other animals whose skins could not be reclaimed were killed by poisoning. Ordinarily the United States Biological Survey has from 250 to 350 professional hunters permanently in its employ. The area wherein predatory animal control is practiced includes ten districts: Montana; Idaho; Washington and Oregon; Nevada and California; Utah; Wyoming and South Dakota; Colorado; Arizona; New Mexico; and Texas.

The accompanying illustration is of interest, showing as it does the result of a day's work by a hunter. Some of the skins have a considerable market value as fur, which fact offers a powerful incentive for the numerous hunters.



Results of a day's work in freeing a western stock range of marauding animals

Ice Formation Over a Stream

By Ford Ashman Carpenter
U. S. Weather Bureau

DURING a recent journey to the mountain precipitation stations of the Weather Bureau located on the northern slopes of the Sierra Madre, southern California, an interesting example of the freezing of spray from a swiftly-moving stream was obtained. The accompanying photograph, made by Mr. B. F. Burkhart, illustrates this phenomenon. This ice formation occurred on Pallett Creek, Devil's Gulch, on the desert or northern slopes of the Sierra Madre. It appears that the cause of this unique occurrence was the unusually high water in the stream and the accompanying low temperature of the air. The flood shifted the channel of the stream to where there was considerable overhanging brush and low shrubs. This was especially true where the desert bush, *Cascara sagrada* flourished, as shown in the photograph which illustrates these notes. The preceding weather conditions were characterized by heavy rain and snow, southerly winds, and maximum temperatures approaching 32 degrees and minimum temperatures approximating 18 degrees. The uncommon character of this occurrence may be gathered from the fact that this kind of ice formation has been observed but once before in the past decade and never before made the subject of investigation or heretofore photographed.

Extraordinary ice formation caused by the freezing of spray from the stream upon the overhanging bushes

A Record Shot of Grizzly Bears

TWO hunters from Vancouver, one of whom was the SCIENTIFIC AMERICAN'S correspondent, F. J. Dickie, in June established a new and unique world's record in the killing of grizzly bear in the Canadian Rockies along the line of the Pacific Great Eastern not far from Lillooet, acknowledged by big game sportsmen of world fame as one of the best grizzly districts in the world. They shot four good sized grizzly at once, the entire time occupied 30 seconds. Not one of the bears succeeded in getting 30 yards away, as is evidenced by the picture, for in the deep soft snow if they had been any considerable distance apart it would have been impossible for men to get them together for a picture. They stalked the bears while they were feeding, but before they got to them the bears had lain down on a ledge of rock jutting out from the side. The wall of this proved an advantage of which the hunters availed themselves when they noted the bears' movements. By going above the bears up the mountain side and then crawling straight down upon them, the wall of the ledge, sheering straight up about four feet before blending with the slope, shut off the grizzlies' view. Through this the men were able to make a remarkable stalk to within less than a hundred feet. Though they had only a .30 and a .33—rifles which many big game sportsmen claim as too light for an animal so tenacious of life as the grizzly—this close crawl and the reclining bears formed a situation unique in the record space of time of half a minute. The bears ranged in size from 9 feet 2 inches, the biggest, to 6 feet, 6 inches, the smallest. The number, size of the bear and the time occupied in killing them makes a record that has never been closely approached in the history of the North American continent.

Four grizzlies in thirty seconds

Traces of Gas

THERE is quite a tendency, just now, to attribute every unusual phenomenon that may be observed to the poison gas that has been released on the battle fields of Europe. Whether it be the severe weather of last winter or the unseasonably warm weather of the present late fall, whether it be a prolonged absence of rain where rain was expected or an abnormal downfall where such a thing does not ordinarily occur, everything gets blamed on the gas; and now we have the epidemic to be attributed by enthusiastic explainers to the same cause.

Now, of course, everybody understands that much of the gas is soaked up and permanently retained by the ground; and that much more undergoes, sooner or later, some form of chemical change, either through the use of antidote gases or in the ordinary course of nature. Nevertheless, it is quite plain that, as human efforts go, there is a very considerable amount of the gas that remains unchanged and finally comes to constitute part of the earth's atmosphere. So analogy is drawn from the Krakatoa dust cloud that travelled two and a half times about the earth, leaving in its wake a train of unseasonably cold and dreary days; and we are asked to believe that the gas from France does something of the same sort.

Before we accept these views, it might be well for us to indulge in a little calculation. Taking the radius of the earth as 4,000 miles, the total surface area figures out at 200,000,000 square miles—in round numbers, of course. The weight of the atmosphere is 14.7 pounds for each square inch of the earth's surface; and allowing 4,000,000,000 square inches to the square mile, an error of far less than one per cent, this gives us 60,000,000,000 pounds, or 30,000,000 tons, of air per square mile. Accordingly, the total weight of the atmosphere, still in round numbers, is represented by the imposing figure of 6,000,000,000,000,000 tons.

Against this, it is now necessary for us to ask what amount of poison gas has been added. We have semi-official data on this point which makes it clear that the Germans have employed far less than 100,000 tons from the beginning right down to date. The Allies have so improved upon the teachings of the Huns that the latter are now mighty sorry that they ever started the gas business; even so, we are quite safe in imposing an absolute upper limit of 300,000 tons upon the aggregate weight of gas that has been turned loose in France and Belgium and any other theater of conflict in which it may have found employment. As suggested, not all of this is now with us in the form of atmospheric pollution; but we do not really know how much has been got rid of. Perhaps, since we are dealing with limiting values anyhow, it will be most satisfactory to forget this feature entirely, and content ourselves with the knowledge that no more than 300,000 tons of poisonous gas has been added to the atmospheric complex. And this figures out one part in 20,000,000,000, truly nothing to worry about.

So if any friend of any reader endeavors to attribute any of the world's many ills to the presence of poison gas in the earth's envelope, said reader may confront him with this demonstration, and inquire gently, but none the less firmly how much difference he thinks one twenty-billionth part of the whole would be likely to make. It would indeed seem that this might fairly be classed among those things of which the mathematician talks so glibly under the title infinitesimals.

A Radium Substitute

THE increasing demand for radium for medical work, but more particularly for luminous paint, has made the question of possible radium substitutes of considerable importance. An excellent substitute for certain purposes is mesothorium. This is a radio-active element found in monazite sand and other thorium minerals. When first extracted it is not in a satisfactory condition for luminous paint, but must be allowed to "ripen" for several months or even a year before it can be used, during which time the alpha radiation required for luminous paint becomes sufficiently strong. On the other hand the beta and gamma radiation of mesothorium grows rapidly and it can be used for medical purposes within a few days after preparation

Radium has a long life, half of it decaying in approximately 1,600 years. Mesothorium on the other hand has a short life, five or six years being its useful life for luminous paint purposes. The price in the past has varied from 40 to 60 per cent of that of radium, the comparison being on products of equal activity. For medical purposes, therefore, it cannot compete with radium as long as there is plenty of the latter; for luminous paint, to be used on objects which themselves have a short life, it is an excellent substitute for radium and will tend toward the saving of radium for medical purposes.

Until recently no mesothorium was recovered in the United States, although large quantities of monazite sand are annually treated for the manufacture of incandescent gas mantles. Such a condition has represented an important mineral waste.

Shortly after the United States entered the war the Bureau of Mines made a cooperative agreement with the mantle interests for the study of methods of extraction and recovery of mesothorium. The work was carried on at the Rocky Mountain station of the Bureau of Mines at Golden, Colo. Successful methods of extraction and recovery have been worked out and connected up with the regular metallurgical processes of mantle manufacture. Mesothorium is now one of the regular products made by this company, and is recovered from practically all the monazite sand treated in the United States.

World Markets for American Manufactures

Edited by LYNN W. MEEKINS

A department devoted to the extension of American trade in foreign lands

Modernizing Oriental Industries

THERE are more wheels going around in Far Eastern countries today than ever before—modern rubber-tired industrial wheels that are doing many kinds of work more efficiently than it could be performed by thousands of hands. Asia has such a dense population and labor has always been so cheap that the front door was slammed in the face of modern industrial machinery until comparatively a few years ago. But once inside, it began to make things hum. In Japan manufacturing has fairly pounded ahead since the beginning of the war. It is China, though, that offers the best market in the Orient for the sale of American industrial machinery, according to an engineer who has been over the ground.

The reason is not far under the surface. China has coal and iron and other necessary raw materials. In its population are millions of intelligent workmen. The Chinese are as enterprising as the best of them. Organization is the one thing lacking, but its seeds are being sown in the numerous undertakings of foreigners in China. The Chinese are eager to learn, and they are very greatly interested in the big things that America is doing. Recently an American trade commissioner, who is investigating transportation facilities in the Far East, reported the admiration of the Chinese when he showed them pictures of our railroad development and our wonderful progress in shipbuilding.

Kinds of Machinery Needed

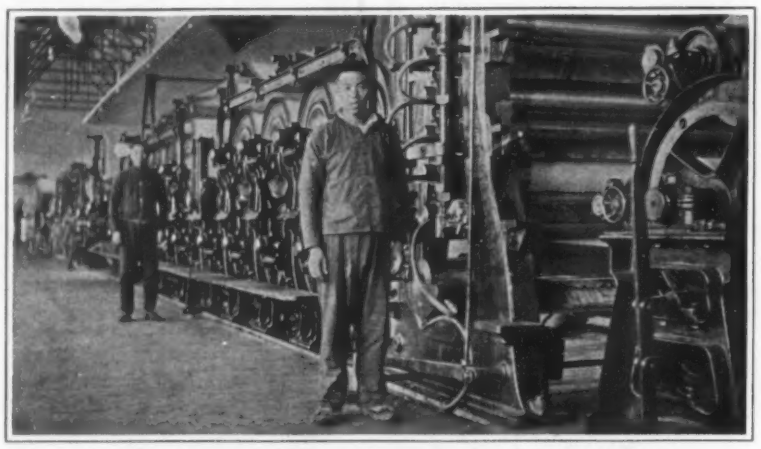
The export trade in machinery differs from that in other lines in its large dependence upon ever-changing opportunities. Its fluctuations from year to year are not important because there is nothing consecutive about the trade. One year, for instance, sales of textile machinery may be heavy, and the following year refrigerating machinery may lead. As far as China is concerned, however, the cotton-spinning industry has called for the most American mechanical equipment. The prevailing impression that a certain make of British machinery is simpler to operate and requires less mechanical skill has enabled British manufacturers to provide much of the equipment of Chinese cotton mills, the products of which are remarkably similar. During the period of the war British manufacturers were unable to maintain the volume of their exports, and the American machinery that China has purchased is proving so satisfactory that more is wanted. American machinery is used in a number of Chinese government paper mills.

One of the most rapidly advancing industries in the Orient today is the crushing of vegetable oils. This has created a very large demand for special kinds of American machinery. It is important that the manufacturer should know just what work his machinery has to do. For example, the cotton seed of India is inferior to that of the United States, and the equipment for pressing oil from it is 50 per cent more expensive than the necessary apparatus for crushing American cotton seed. The yield of the oil is less, and the value of the oil cake is smaller.

Where Initiative Counts

Selling American machinery in the Far East means having a man in the field who is not dependent upon alarm clocks and who can see beyond the horizon. This is how a half-million-dollar contract came to the United States. A large American corporation had an alert resident engineer in Japan. One day he heard indirectly that plans were under way to modernize a sugar plantation in Formosa. As soon as the proposition crystallized and the money behind the enterprise began to talk, this man cabled to his firm and advised that an expert be sent to look things over. Drawing a salary of $500 a month and expenses, the expert went to Japan and the resident engineer accompanied him to Formosa, where they examined the cane fields and decided what kind of equipment was needed. They spent eight months in Formosa, where the temperature reaches at times 120 degrees in the shade. As a result they sold a complete mill, with a daily capacity of 500 tons of cane, producing white sugar. Two thousand tons of machinery were required. This incident illustrates the necessity of taking a flier. A whole year's profit was risked, but the game was well worth winning.

Throughout Asia there is a market for modern filtration plants. Typhoid is prevalent, and drinking water must be boiled. Within the past decade the first municipal filtration systems have been introduced in Japan, China and Korea. There is a considerable demand for power plants. Sales of electrical material in recent years have been limited only by the possibility of importing it. More railway equipment is needed for the new lines that are now under construction.



Complete American paper-making machinery plant installed in a Chinese mill (Hankow)

The adaptability of American machinery is apparent from a story told the other day by a salesman who had just returned from Japan. "I had a very successful trip," he said, "and sold many kinds of machinery, but the most interesting order that I received was for a popcorn popper which an enterprising Japanese uses to parch rice." Shanghai in China and Kobe in Japan seem to be the best places for American manufacturers to enter the machinery markets of those countries. Making their headquarters in busy trade centers such as these cities, American representatives can keep an eye on new industrial developments and profit by them.

Over the Border

SINCE 1910 the most polite word that can be applied to conditions in Mexico is "unsettled." It is the opinion of an American business man who returned last month from a trip through the republic that the only cure for Mexico's internal complaints is the joint administration of a carefully compounded soothing syrup by the United States, Great Britain and France. The revolution has simmered down to a series of bandit raids, which continue because most of the army is tramping the ties along the railroad from Laredo to Mexico City, and from there to Vera Cruz. These lines are being kept open by removing rails and other equipment from various parts of the country and using them to maintain these necessary routes.

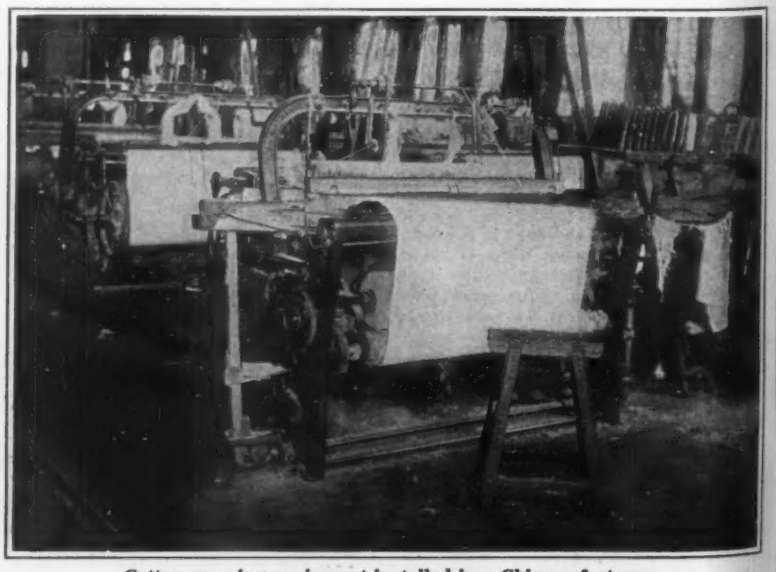
The banks that are open confine their operations to dealing in exchange on New York. All business is conducted on a strictly cash basis, and credit is neither asked nor given. Since 1913 trade in the northern part of Mexico has been carried on mostly through Texas distributors in San Antonio, El Paso and Laredo. The central part of the repulbic is served from Mexico City; the east coast, from Tampico and Vera Cruz.

For such near neighbors, Mexico and the United States know very little about each other. Down there St. Louis is probably the most familiar city in the United States. Up to a few years ago, there was through train service between Mexico City and St. Louis, which gave the latter city a commanding position in our export trade with Mexico. Although present conditions in Mexico are still far from serene, this seems to be an opportune time for American firms to send men to that field. It is true that all sorts of merchandise is subject to pilferage while in transit through the country, and most shipments reach their destination in damaged condition. Goods are subjected to long delays in the Mexican customhouses, but these are things for the Mexican importer to worry about. The American manufacturers and exporters, who receive payment for their products before making shipments from the United States, are protected, and there is no reason why they should not do as much business with Mexico as they can. Increased trade more than anything else will favor the return of prosperity.

A recent visitor from Mexico City says that the stores in the capital are fairly well supplied, although some goods are priced very high, as might be expected. "Seldom has a country been compelled to practice such self-denial as Mexico," he said. "Since 1910 practically all construction work has been suspended. Many improvements, state and municipal, are in a partly completed condition, gathering rust, depreciating so much that what has been built will probably have to be torn down. Schools are closed because funds are lacking to maintain them. If the present government had sufficient revenue, it could probably restore the country to a sound economic basis. But the tax collector has a pocket much larger than his conscience, and finance is a matter of scraps of paper—thousands of banknotes issued by the Government that have not enough value to be called money."

So few of Mexico's 15 million inhabitants can read that the present advertising appeal must be made through illustrated signs, and goods intended for Mexican consumption must bear a distinctive and conspicuous pictorial brand—some animal or other object familiar to the illiterate consumer. People must see the articles they are asked to buy. The best markets just now are the larger cities, with populations increased by refugees from the rural districts where life consists of dodging one bullet after another. With a good police force and a Secretary of the Treasury imbued with McAdoo ideas, our southern neighbor would regain its place in world commerce.

The cloth room in a Shanghai cotton mill



Cotton-weaving equipment installed in a Chinese factory

"In saving gasoline and oil, in reducing wear and tear on the truck, and in eliminating delays during the winter, Goodyear Pneumatic Cord Truck Tires have won permanent adoption by us."—Boston Woven Hose & Rubber Company, Chicago, Ill.

THIS company compared a 1½-ton truck on Goodyear Pneumatic Cord Truck Tires with a 1-ton solid-tired unit doing the same kind of work and covering an equal distance daily.

The heavier Goodyear Cord-equipped truck used only 5 gallons of gasoline daily as against 8½ gallons consumed daily by the one-tonner on solids.

And the former used only 5 quarts of oil weekly while the latter consumed 7 quarts weekly.

Further, mechanical expense was only $20 in a year on the Goodyear-shod truck but much higher on the other because of the constant jarring on solid tires.

Such results of the use of the pioneer Goodyear Pneumatic Cord Truck Tires plainly recommend them to executives whose hauling conditions call for this type of tire.

The Goodyear Tire & Rubber Co.
Akron, Ohio

GOODYEAR
AKRON

This Used to be the Bridge Club

—and many a jolly afternoon they had, too, with their aces, and hearts, and jacks, and no trumps.

Then the war came!

Brothers, and husbands, and sons, and sweethearts went away to become aces of the air, or jacks of the navy, or trumps of the American army.

The afternoon meetings continued—but the scenes changed to Red Cross workrooms—and serious, busy fingers of hundreds of thousands of patriotic American women have been making bandages and surgical dressings to alleviate the sufferings of their boys, and your boys, who responded so gallantly to the country's needs.

They are giving their time, their energy and their devotion to the cause of humanity, without stint or murmur.

And now comes your time to give your approval to the work your Red Cross has been doing.

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The Current Supplement

AN interesting suggestion relating to the study of fossils will be found in a paper on *The Structure of the Skeleton in Invertebrate Animals* in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2242, for December 21st. The author believes that investigations of the microstructure of many fossils will prove of great value to paleontologists. *Maintaining Ocean Telegraphs* gives some facts, and raises the question whether the submarine cable will survive in competition with wireless systems. It is illustrated by a number of photographs. *Definition of Valency* discusses an important chemical principle, and constitutes a valuable review of the problem. Holland, a country famous for her great feats in hydraulic engineering, has made extensive plans for wresting great additional areas from the Zuider Zee, thereby gaining 2,000 square miles of solid land that will be of enormous value for agricultural purposes. The story of this great project will be found in an article entitled *Holland Seeks a New Province*, which is accompanied by several excellent illustrations. *A Surface Having Only a Single Side* is an interesting investigation of a curious geometrical problem, and the discussion is illustrated by several diagrams. With the war came a shortage of photographic developers, and many substitutes have been placed on the market, as well as home-made specimens of some of the old standard chemicals, and as a result the services of the chemist have been necessary to check the purity of some of the substances offered and to expose the composition of others less worthy. To those interested in this direction the paper on *The Examination of Organic Developing Agents* will be of great value as it describes methods for investigating and testing a great number of the substances now on the market. Other articles of special interest in this issue include *The War Palm and Its Uses; The Functions of the "Sacral Brain" in Dinosaurs; Aviation and the War. Steam Turbine Development and Tendencies* and *The Relation of Light to Health.*

The "Hush" Ships of the British Navy

(Continued from page 491)

removal of the after gun and the construction of a long runway or launching platform extending from the bridge aft. The structure was built of steel, the vertical columns upon which it was carried being placed inboard far enough to permit the operation of the secondary battery, a few of the guns of which will be noted in the illustration.

The erection of these platforms, which, as the photographs show, were structures of great width and length, involved, of course the addition of a large amount of weight; but if the guns were of the size stated above, the removal of the after 15-inch gun and its turret, mounting, and ammunition supply would probably compensate for the weight of the platform.

The length of these ships on the waterline is 840 feet. At a ratio of 10 to 1, the beam would be about 85 feet.

A Place for Every Man

(Continued from page 495)

It is not desired that any employer "make work" for men by putting them on his payroll merely as a charity. It is desired that employers extend their activities where possible, in order to give men a chance to work. It is most emphatically not any help for an employer to throw a civilian steam fitter out of a job that the ex-soldier steam-fitter may get the job. Whether we have two million jobless men from the army or two million jobless men from civil life matters little—the one is as bad as the other.

Designed primarily for soldiers and sailors, in many communities the Bureau will care also for those civilians who have left their peace time jobs to take positions with concerns engaged in doing war work. In many places the facilities of the Employment Service are sufficient in themselves to care for the civilian workers; in other places it may become a community necessity that the Central Bureau should be for soldiers and sailors and war workers so as to give assistance to civilians who have been engaged in war work and who cannot readily find employment.

Never before in the history of this country has governmental power been invoked to settle the question of unemployment. The present Service, its ramifications, its utilization of the thousand arms of the allied war-work organizations, and the complete defense system, fostered and grown by the National

(Continued on page 506)

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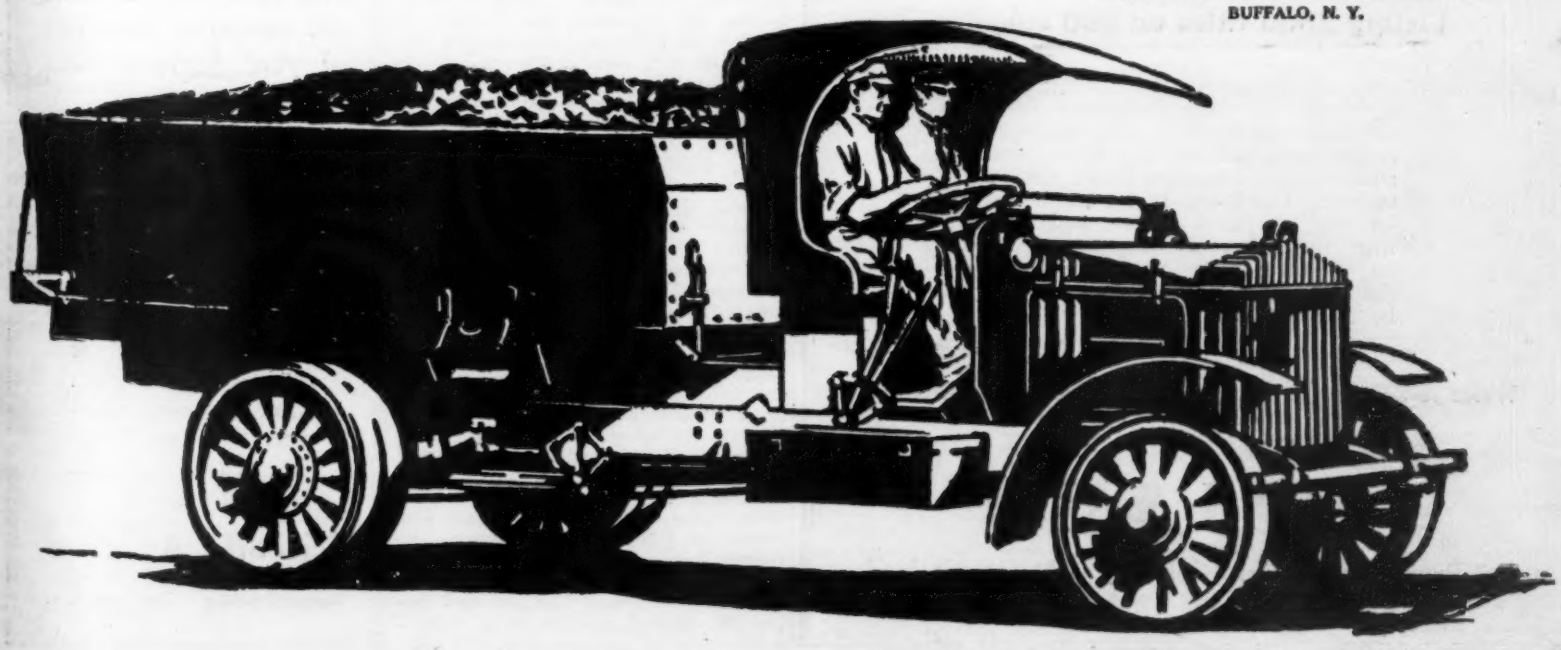

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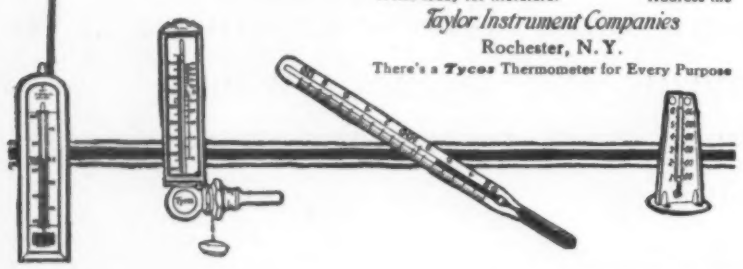

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A Place for Every Man

(Continued from page 504)

Council of Defense, marks an entirely new standard in government coöperation with private industry. True, never before has there been such a gigantic need, but to find it being so well met is perhaps the best indication that the Government has a real appreciation of the undoubted fact that the very keynote and fundamental of all reconstruction problems is the human problem, and that no program, no matter how elaborate and well worked out, which does not first consider the elementary need of work, wages and thus food, shelter, clothing and health, can possibly succeed.

The End of the World War

(Continued from page 496)

dagger pointed at the heart of the Italian kingdom. Today not only are they held by Italy but Italian troops have crossed the Brenner Pass and are holding Innsbruck in the Austrian Tyrol. Italy has now acquired a barrier on the north that renders her secure against any attacks from an enemy coming through the passes in the Alps.

The German Débacle

Although the Allies began this year their counter-offensive on the western front in July by their drive against the German salient at Chateau Thierry and again in August against the salient near Amiens, the real decisive move of the last great battles began early in October, when the Allied generalissimo threw the combined British armies against the Hindenburg lines from St. Quentin to Cambrai. British troops in their advances on September 1st had occupied Peronne and, two days afterward, moving forward on both sides of the Arras-Cambrai road, they also broke through the strong defensive system known as the Drocourt-Quéant lines. All the way from Cambrai to Soissons, the Allied troops continued to make gains and on September 10th they had arrived within range of the old Hindenburg lines, having in the meanwhile retaken practically the entire ground lost during the four great German offensives from March 21st to July 18th of the present year. It will be recalled that from the North Sea to Switzerland there were continuous lines of defenses almost all of which were held by the Germans before their drives in the spring and early summer of 1918. They had withdrawn to these lines in their retreats in 1917 and had held them in force ever since. The American troops had attacked in September both sides of the St. Mihiel salient southeast of Metz and had flattened it out, retaking about one hundred and fifty square miles of French territory and capturing many thousands of prisoners and hundreds of guns.

After that work had been accomplished, practically nothing in the way of active operations took place to the southeast of Metz and Verdun up to the time of the armistice. All of the operations leading to the final termination of hostilities occurred on those parts of the lines north and west of Verdun, *i. e.*, over those portions of the front that included the Hindenburg lines. These last consisted of a series of separated lines running generally east and west and connected by numbers of cross trenches and interwoven defences; so that, if one set of lines was penetrated or crossed, others were found to the rear in supporting distance of equal strength and easily reached by the connecting cross trenches and communications. The hinges of the entire combination can be said to have been in the strong fortifications in and around Lille on the north and around Metz on the south; together they held together the lines from the Belgian coast to Mulhausen. Metz of itself was vital to the southern sector but, on the north, the line of the Scheldt gave an auxiliary anchor, should Lille be taken.

The Allied commander began his attack, toward the last of September, by throwing French and American troops against those parts of the German positions in the Champagne regions between Rheims and Verdun, *i.e.*, in the flat country east of Rheims to the Argonne forest and Verdun over a front of 50 miles. The Germans were driven out of their first lines all the way from the Aisne to the Meuse where the movement stopped. Next came a blow at the other end when the Belgians and British attacked and penetrated the German lines from the valley of the Lys River to the seacoast. At the same time the British attacked Cambrai and Le-Catelet, making material gains over a dozen miles of advance and capturing

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prisoners and guns. Then followed an immediate attack by the French army on the Germans on an eight-mile front between the Vesle and the Aisne, so that the latter were forced back to the Chemin-des-Dames and the lines of the Aillette River.

The effects of all of these drives was to break through the first lines on both the north and south ends and to force the enemy back to the next supporting points. Around Cambrai and St. Quentin not so great an advance was made; but the pressure was such that the Germans could not concentrate at any particular point, and the vaunted Hindenburg line was threatened at its center by the strong frontal attacks of the British. On October 4th and for some succeeding days the British commander launched a furious drive with British and American troops against this weakened center; the attack extended for 30 miles from northeast of Cambrai to the southeast of St. Quentin; Cambrai was taken and the drive continued east of the Cambrai-St. Quentin line until the Scheldt was reached south of Valenciennes. In the meanwhile, heavy blows were being delivered both on the north in Flanders and on the south in the Champagne. The British and Belgians had been reinforced with French troops; they were therefore able to break through the last line of German defences between the sea and the Lys valley and, by pivoting on the right, to swing around north of Lille and to threaten all the crossings of the Germans over the Lys River. Down in the Champagne the French and Americans again drove forward, reaching the Aisne with the right wing and crossing the Aisne east of Laon with the left wing. This advance flanked the German lines between the Aisne and the Oise and caused the abandonment of Laon and the heights and forest of St. Gobain. The latter had proved to be a great central fortress that had for months blocked the path of the Allies in their attempted advances from the south toward Laon.

The situation in the middle of October was most encouraging and showed successes that under normal conditions, would have seemed almost impossible. For in three weeks, the whole German line from the sea to Verdun had been driven back; the Hindenburg line had been broken, together with many of its supporting defenses. While up to that time the Germans were neither demoralized nor thoroughly beaten, it was more and more evident to all that the result of the three weeks struggle was a defeat that destroyed all hopes of a victory or of even a deadlock, and rendered certain in the near future, the freeing of France, if not a military decision involving possible surrender.

When the struggle again began, the Germans were soon forced back to their last lines from the frontier of Holland to Valenciennes. Below the latter city the strongest opposition was offered in order to hold the railroad running through Avesnes to Mézières and Metz; this was the main supply line with its branches for all the sector between Valenciennes and Metz, and it was also the main line for moving stores and supplies from the evacuated parts of Belgium. But Valenciennes fell to the British troops on November 1st and the Americans at the same time broke through the German lines between the Meuse and the Argonne Woods. The effects of these two disasters to the enemy were at once apparent, for the line of the Scheldt River could hold only a short time; all the lines between the Oise and the Meuse had to be given up; and only a short stand could be made from the line of the Sambre River all the way to Metz. The American forces were pushed forward to close the gap of Stenay between the Meuse River and the Ardennes; once accomplished, the German armies were split in two with every prospect that all the forces between the Oise and the Meuse would be forced back to the Ardennes, surrounded, and captured.

The first days of November saw the pursuit of the Germans by the British across the Belgian frontier towards Namur, and the French pushing them back in the same direction with the threat of cutting them off from their lines of retreat. The American troops had taken Sédan, of sad memory for the French, and were prepared to move east to the railroad centers of Longuyon and Longwy, or west to Mézières to complete the envelopment of the retreating Germans. The broken and dispirited German armies were retreating everywhere from the Dutch frontier to Metz, fighting back, it is true, but only to postpone the fatal day when they must yield; perhaps somewhere west of the Rhine, a stand might have been made, but it is doubtful.

The master strategy of the Allied commander, controlling the forces of the Allies, was a marvel of the science of war and will henceforth rank with that shown in any campaign of the great commanders of modern armies. In but little more than three months, victory had been snatched from the Germans; they had been driven out of France, and had been put to an ignominous flight back to Germany; nothing was left for them but to seek an armistice and to make a surrender. This they did; and by the terms of the armistice Germany has been rendered powerless for future trouble.

To carry out all the terms of the armistice is imposing, and will impose for a long time, a tremendous burden upon the German military administration—especially if the present revolutionary governments established in Germany do not work smoothly. Field Marshal Hindenburg is apparently doing his best under most adverse circumstances; but time only can tell whether he can succeed or whether the Allies must take matters in hand and enforce their own demands.

It is certain that the Peace Congress about to assemble in Paris will be called upon to remake the entire map of Europe and will find in its path many difficulties to overcome. Already threats of conflict between the Jugo-Slavs of Croatia, and of the Dalmatian coast and the Italians in the same territory are in the air. These misunderstandings are only some of many that have arisen, or will arise, while the Congress is in session, and they will require long consideration and delicate adjustment. It is to be hoped that the proposed League of Nations may soon be formed, so that future conflicts, like the great war that has so cursed humanity for four years, can be averted and that the time will soon come—

"When the war drums throb no longer
And the battle flags are furled,
In the Parliament of Man,
The Federation of the World."

The Needs of the Patent Office

(*Continued from page 497*)

with the needs of the other Bureaus which make up the Interior Department. No increase of salary of Commissioner or Examiner of Patents can be considered by the Secretary of Interior without considering the salary of the Commissioner of the General Land Office, the Commissioner of Pensions, and some of their assistants. For the Secretary knows that he may easily create jealousies in his own department; and no matter what he decides the committees of Congress will make the same comparisons when they pass on his estimates.

After an experience of four years under a Secretary of great ability with whom my relations were most cordial, I am convinced that the Patent Office gains nothing by being a Bureau of the Interior Department and that it is greatly handicapped by that connection.

New commissions and offices of every description are started on the basis of present day needs. But with an old office like the Patent Office any attempt to make a radical improvement is hopeless unless supported by public demand. Business men and committees of Chambers of Commerce can bring influence to bear that Congress will respect, and in this way the Patent Office presents to every manufacturer and business man an opportunity for constructive work of great practical importance.

Concerning Cotton Seed

(*Continued from page 498*)

remove the hulls before caking and pressing, as in this manner the oil yield is increased and a colorless oil is at once obtained which is very easily refined. For this purpose a decorticating machine is used, which is essentially a revolving barrel, with many rotating and a few stationary knives. Getting between these, the hulls are split and the seed meats fall out whole. The latter pass through a screen which retains the hulls, but to make the separating process efficient it is important that a little lint shall still adhere to the hulls. Only decorticated cotton seed cake is used for the meal and flour destined for human consumption. A second delinting process is applied to the hulls, and the remaining shell bran is used as a roughener in the various oily cattle-feeds produced as a by-product.

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tage, both as regards the oil yield and the value for cattle feed, has thus been turned to doubly good account. In British practice, based in the first instance on handling the bald Egyptian seed, whose very smooth hulls are not so readily separated from the meats, decortication has not yet been generally adopted. As a result, the tarry compounds and deep coloring matter contained in the hulls must be removed from the oil by refinement processes. The consequent waste of oil is from 11 to 15 per cent, and higher if the woolly Indian or American seed is used. On the other hand, the crushed hulls in the press cake are considered valuable for cattle feeding purposes, especially as a roughener during the milch and pasturing periods.

The most recent American practice may then be summarized as follows: Planters dispose of the cotton in the boll. Ginning and baling are done at the mill. The seed is subjected to a preliminary delinting. The delinted seed is hulled. The meats are slightly crushed and caked for the oil presses. The press cakes are broken up and ground to meal for cattle feed. If intended for human consumption, the meal is ground into flour. The hulls are subjected to a final delinting process, and the last small crop of lint resulting from this is employed as was the first. The shell bran is utilized in cattle feeds.

Some of the Rarer Metals—a Pot Pourri

(Continued from page 500)

instantly decrease its electrical conductivity and upon removing the light it assumes its normal conductivity. The photophone is based upon this fact and in this instrument light is converted into electricity which becomes the basis for measuring the light of stars.

The red fire that delights the eye and is so useful in beacons and signals depends upon a compound of the metal *Strontium*. The war has created an American production sufficient for our needs. The metal has a specific gravity of 2.54 and a melting point of 900° C., but it is seldom produced except as a chemical experiment. Strontium hydroxide is used extensively in Europe for clarifying beet sugar juice and for recovering sugar from the residual molasses in beet sugar factories. In the absence of strontium, lime is used here for the same purpose.

Tantalum, with a melting point of 2900°C. and a specific gravity of 14.49, was the first metal to be used in any quantity for electric lamp filaments. It has a high resistance and is very ductile, enough wire for 45,000 lamps of the usual kind being drawn from one kilogram. Even this large figure was exceeded as improved methods for drawing wire were developed. With the exception of hydrofluoric acid, tantalum resists all acids, organic or inorganic, and imparts this quality as well as hardness to steel alloys. It seems especially well fitted for surgical instruments and may be used for pen nibs in the place of iridium. When worked a superficial oxide is formed which makes it difficult to abrade tantalum. A diamond drill penetrates such a sheet with difficulty although it may still be rolled.

Tellurium has been described as the metal without a job and the black sheep of the metal family. It is secured as a by-product when copper is refined and is a white, metallic, crystalline substance melting at 446°. Its specific gravity is just over 6. and in many ways its compounds resemble sulfur and selenium, but their enduring odor is that of decayed garlic. There has been some effort made to take advantage of the electrical resistance and conductivity of the metal, but so far without commercial success.

Thallium costs several dollars an ounce, but it has been used in certain grades of high refractory hard glass from which artificial gems are sometimes made. The metal is lead-like in appearance, is heavy, specific gravity 11.85, melting point 302°, is very soft and has a low tenacity.

The success of the incandescent gas mantel and through it the life of the gas lighting industry is due to the oxide, thoria, of the metal *Thorium*. Thorium melts above 1700° and the oxide is infusible. The nitrate is used to impregnate the woven fabric and the oxide is formed by ignition. One per cent cerium is used to impart a yellow tinge to the light and to prolong the life of the mantle. Due to its infusibility and the ease with which the metal combines with other elements, it is rarely prepared. Thorium is accompanied by *Mesothorium*, which closely resembles radium. After it has been isolated from other elements for about a year, it may be used in luminous paints and while it is not suitable for such paints during that year it is, nevertheless, efficient in therapeutics and may be employed in cancer treatment, etc. The use of mesothorium in paints has been urged as a method for conserving radium.

Titanium has been the cause of many a discussion in the metallurgical field, but there seems little doubt that its alloys produce an increase in transverse strength and in the elasticity of steel. In one large scale test rails with no titanium passed test to the extent of but 36 per cent, 0.053 per-cent, titanium increased this to 43 per cent, 0.077 to 84 per cent and 0.10 per cent to 100 per cent accepted. The ferro alloy is usually employed, titanium being very hard and brittle. It was used to some extent in the early lamp filaments the powder being mixed with an organic binder. It was then heated, ignited and sintered by passing a strong current through the wire. Its brittleness was, however, against it. 1795 per cent C. is the melting point; 4.5 the specific gravity.

Compounds of titanium are used in dyeing leather and textiles and in ceramics.

Tungsten is hardly a rare element now due to its important service as a tool steel alloy and in electric lamps. The work incident to learning how to make a tungsten wire is one of our modern classics in science, and goes back to the preparation of the oxide itself. The high melting point of tungsten, 3267°, the highest of any metal, is largely accountable for its usefulness. Its specific gravity is 18.77. Before the war nearly all the tungsten was mined in British possessions and refined in Germany. The United States is now a large exporter.

Uranium as metal is used to impart hardness and toughness to steel. The carbide has been used as a catalyst in ammonia synthesis especially in Germany and uranium compounds enter into the glass industry for a opalescent yellow color, as a pigment for ceramic glazes, as mordants in the textile industry and to a very limited extent in gas mantles. Uranium occurs along with radium, has a specific gravity of 18.685 and a melting point of 800° C.

Vanadium is white like cast iron. It tarnishes with difficulty at ordinary temperatures and increases the elastic limit and ultimate tensile stress without reducing the ductility of alloy steels when used in from 0.1 per cent to 0.25 per cent in chromium-manganese and other steels. Vanadium is prepared by the thermite process and is an American development. Vanadium steel is noted for its shock resisting qualities. Vanadium compounds are used in indelible inks, for calico printing and to produce a gold of greenish tinge in porcelains. It melts at 1720° C. and its specific gravity is 6.025.

Yttrium is iron gray. It has no commercial uses and may be considered a chemical curiosity.

Zirconium has the color of cast iron and its compounds are useful because they are so highly refractory. The incandescent body in the Nernst lamp was about 85 per cent zirconia and as this oxide conducts electricity only at a high temperature it required to be preheated. Zirconia is so refractory that platimum or quartz may be melted in a crucible made from well ignited material. Zirconia melts at 2500° C., the amorphous metal at 1500° and the crystalline variety at 2350° C.

There are other commercially important and comparatively rarer metals including magnesium, manganese and chromium. The metalloids, such as boron but recently made available also have their usefulness. Silicon, especially ferro-silicon occupies a large place.

These are some of the building stones of the comparatively thin, very thin, portion of the earth's crust as examined over a fraction of its area. They are elements so far as we now know, but there are those who believe one ultimate substance composes all elements being merely arranged in different special forms to produce the many varieties of matter which we have not learned how to simplify.

Canal Zone Investigations

A FEW years ago a thorough biological and geological survey of the Panama Canal Zone was carried out by the Smithsonian Institution, in coöperation with the U. S. Geological Survey and other branches of the Government. The results of these investigations are now in course of publication in quite voluminous form. Initial volumes include "Contributions to the Geology and Palæonthology of the Canal Zone, Panama, and Geologically Related Areas in Central America and the West Indies," by T. W. Vaughn, and "Mammals of Panama," by E. A. Goldman.

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